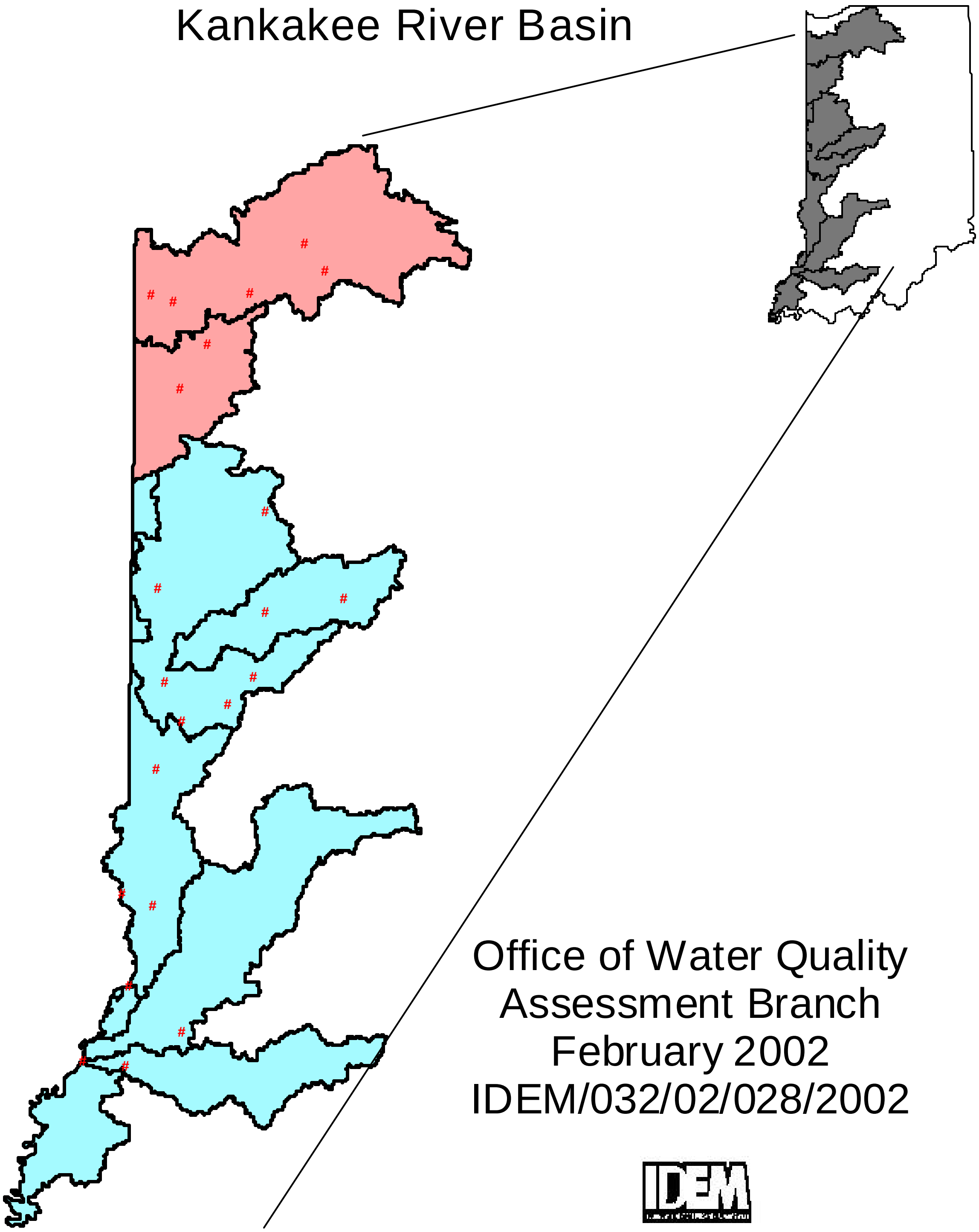
An Assessment of Pesticides in the Lower Wabash River Basin and Kankakee River Basin



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Abstract

The Assessment Branch has a Surface Water Quality Monitoring Strategy based on a 5-year rotating basin schedule. One portion of this strategy is the Pesticide Monitoring Program. In 1999, the Lower Wabash River and Kankakee River Basins were sampled to collect surface water samples to analyze for 145 toxic chemicals. These chemicals consisted of numerous pesticides (herbicides, insecticides, and fungicides), pesticide degradation products, and industrial chemicals. All water samples were collected from April 5 through July 28, 1999. This time period was selected to represent the agricultural season when pesticide/herbicide application was occurring most often. Between the two basins a total of 22 sampling locations were selected for this project. Of these 22 locations, 15 were located in the Wabash River Basin, and the remaining 7 locations were in the Kankakee River Basin. Each sampling location was sampled once a week for 15 weeks resulting in the collection of 330 total water samples for this project. The test method used to analyze various toxic chemicals were SAS5 (Modified EPA test Method 525.2) for 144 chemicals, and EPA Test Method 547 to analyze for just one chemical, glyphosate. Of the 145 chemicals analyzed only 17 chemicals were detected. Of the 17 chemicals detected, herbicides represented 11 of them. Atrazine, metolachlor, and acetochlor were the most represented of the 11 herbicides. The maximum concentrations reported for a single sample for each of the three herbicides were atrazine, 89.0 ug/L on April 5 at Wabash River at Mount Carmel, IL (WLW040-0001); metolachlor, 55 ug/L on April 6 at Prairie Creek near Lebanon (WSU020-0004); and acetochlor, 3.2 ug/L on May 24 at Busseron Creek near Carlisle (WBU160-0002).

The average concentrations, from the two basins combined, during the 15-week sampling season for atrazine, metolachlor, and acetochlor were 3.03 ug/L, 1.28 ug/L, and 0.64 ug/L, respectively. Currently there are no surface water quality standards set for these herbicides. Therefore, to evaluate the results, the Drinking Water Standards, known as maximum contaminant level (MCL) were used. It should be understood the Drinking Water MCL is set for finished drinking water, not for raw surface water. The MCL for the three herbicides are as follows; atrazine, 3.0 ug/L; metolachlor, no MCL set; and acetochlor, 2.0 ug/L.

Based on herbicide concentrations found in ambient water, loading values for each herbicide were determined at each sampling location. To assist in these calculations, crop acreage were determined for each sampling location using Arcview®. The rates of application for the three herbicides were used to determine the amount of each herbicide applied in every sampling location's respective watershed. This data were then used to determine the percent runoff for atrazine, metolachlor, and acetochlor. The last downstream sampling location on the Wabash River (WLW040-0001) had 3.1% (253,957 pounds) runoff out of approximately 8,301,210 pounds of atrazine applied, 0.2% (7,389 pounds) runoff out of 3,715,323 pounds of acetochlor applied, and 0.3% (12,940 pounds) runoff out of 4,755,597 pounds of metolachlor applied. The last downstream sampling location on the Kankakee River (UMK110-0002) had negligible runoff of atrazine and metolachlor. Acetochlor was not detected at this location.

There are no surface water intakes for drinking water located in either of the two watershed basins. It is envisioned the information gathered on pesticide/herbicide loading and runoff in the Wabash River and Kankakee River Basins will be useful for IDEM's Surface Water Quality Monitoring Program and the Drinking Water Branch's Source Water Protection Program to protect Indiana's environment and human health.

TABLE OF CONTENTS

INTRODUCTION 1

STUDY AREA 1

- Lower Wabash River Basin 1
  - Location 1
  - Geology 1
  - Land Use 2
  - Flow & Drainage 2
- Kankakee River Basin 2
  - Location 2
  - Geology 2
  - Land Use 2
  - Flow & Drainage 2

MATERIALS AND METHODS 3

- Sampling Locations 3
- Sampling Methodology 4
- Chemical Analysis 7
- qa/qc Procedures 7
  - Precision and Accuracy 7
  - Equipment Blanks 7

SELECTED PESTICIDE NARRATIVES 10

- Atrazine 10
- Glyphosate 12
- Metolachlor 13
- Acetochlor 13
- Chlorpyrifos 14
- Terbufos 14
- Pendimethalin 15
- Cyanazine 15
- 2,4-D 15

RESULTS AND DISCUSSIONS 16

- Results 16
- Quality Assurance Measurements 17
- General Observations 20
- Loading Calculations 21
- Estimated Herbicide Usage on Corn Crop 26
- Estimated Herbicide Usage on Soybean Crops 27
- Runoff Calculations 29
- Trend Analysis 30
- Drinking Water Concerns 43

RECOMMENDATIONS AND CONCLUSIONS 43

LITERATURE CITED 44

LIST OF FIGURES

Figure 1 Sampling Sites in the Lower Wabash River Basin 5
Figure 2 Sampling Sites in the Kankakee River Basin 6
Figure 3 Percentage of Pounds of Selected Pesticides Applied to Corn and Soybeans for Indiana 12
Figure 4 Data Quality Assessment Levels 20
Figure 5 Loading Conversion Equation and Example 21
Figure 6 Example of the Trapezoid Rule 22
Figure 7 Concentration Over Time of Selected Pesticides at Site UMI020-0002 (Iroquois River at Rosebud) 32
Figure 8 Concentration Over Time of Selected Pesticides at Site UMI040-0001 (Iroquois River at Foresman) 32
Figure 9 Concentration Over Time of Selected Pesticides at Site UMK080-0001 (Kankakee River at Dunn's Bridge) 33
Figure 10 Concentration Over Time of Selected Pesticides at Site UMK110-0002 (Kankakee River at Shelby) 33
Figure 11 Concentration Over Time of Selected Pesticides at Site UMK040-0003 (Kankakee River at Davis) 34
Figure 12 Concentration Over Time of Selected Pesticides at Site UMK130-0001 (Singleton Ditch near Schneider) 34
Figure 13 Concentration Over Time of Selected Pesticides at Site UMK060-0001 (Yellow River at Knox) 35
Figure 14 Concentration Over Time of Selected Pesticides at Site WLV160-0002 (Big Raccoon Creek near Coxville) 35
Figure 15 Concentration Over Time of Selected Pesticides at Site WLV170-0003 (Big Raccoon Creek near Ferndale) 36
Figure 16 Concentration Over Time of Selected Pesticides at Site WLV160-0002 (Big Raccoon Creek near Fincastle) 36
Figure 17 Concentration Over Time of Selected Pesticides at Site WBU160-0002 (Busseron Creek near Carlisle) 37
Figure 18 Concentration Over Time of Selected Pesticides at Site WSU020-0004 (Prairie Creek near Lebanon) 37
Figure 19 Concentration Over Time of Selected Pesticides at Site WPA080-0002 (Patoka River near Princeton) 38
Figure 20 Concentration Over Time of Selected Pesticides at Site WSU050-0006 (Sugar Creek at Crawfordsville) 38
Figure 21 Concentration Over Time of Selected Pesticides at Site WLV010-0002 (Wabash River at Lafayette) 39
Figure 22 Concentration Over Time of Selected Pesticides at Site WBU150-0002 (Wabash River at Riverton) 39
Figure 23 Concentration Over Time of Selected Pesticides at Site WWL100-0005 (Wabash River at Petersburg) 40
Figure 24 Concentration Over Time of Selected Pesticides at Site WLW040-0001 (Wabash River at Mt. Carmel, IL) 40
Figure 25 Concentration Over Time of Selected Pesticides at Site WBU200-0003 (Wabash River at Vincennes) 41
Figure 26 Concentration Over Time of Selected Pesticides at Site WBU040-0003 (Wabash River at Terre Haute) 41
Figure 27 Concentration Over Time of Selected Pesticides at Site WLV150-0003 (Wabash River at Montezuma) 42
Figure 28 Concentration Over Time of Selected Pesticides at Site WLV080-0005 (Wabash River at Covington) 42

LIST OF TABLES

Table 1 Lower Wabash River Basin Pesticides Sampling Locations at USGS Gaging Stations 3
Table 2 Kankakee River Basin Pesticides Sampling Locations at USGS Gaging Stations 4
Table 3 Chemicals analyzed by SAS5 (Modified EPA Test Method 525.2) 8
Table 4 Chemicals analyzed by EPA Test Method 547 9
Table 5 Most Commonly Used Pesticides and Associated Information 11
Table 6 Precision Measured in Duplicate Samples 18
Table 7 Accuracy Measured in Spiked Samples 19
Table 8 Pounds per Day of Atrazine for the Wabash River and White River Sample Sites 23
Table 9 Pounds per Day of Metolachlor for The Wabash River and White River Sample Sites 23
Table 10 Pounds per Day of Acetochlor for the Wabash River and White River Sample Sites 24
Table 11 Pounds per Day of Atrazine for the Kankakee River Basin Sample Sites 24
Table 12 Pounds per Day of Metolachlor for the Kankakee River Basin Sample Sites 25
Table 13 Pounds per Day of Acetochlor for the Kankakee River Basin Sample Sites 25
Table 14 Estimated Herbicide Usage on Corn Crops per Crop Year 27
Table 15 Estimated Herbicide Usage on Soybean Crops per Crop Year 28
Table 16 Percentage of contributing tributaries to the Lower Wabash River Basin 29
Table 17 Rainfall Data for Each Watershed Basin During the Months of April-July 30

LIST OF APPENDICES

Appendix A Field Data
Appendix B Herbicide Concentrations and Stream Flows
Appendix C Descriptive Statistics

Acknowledgments

- The U.S. Geological Survey allowed IDEM access to gaging stations and provided technical expertise.

- U.S. EPA Region 5 initially funded this project for 2 years through a Clean Water Act, Section 319 Non-point source grant. Indiana funded the remaining 3 years.

INTRODUCTION

The 1999 pesticide monitoring program in ambient water was conducted with the following objectives in mind:

1. Identify the occurrence and amount of selected pesticides and semi-volatile chemical compounds in surface waters of the Lower Wabash River and Kankakee River Basins.

2. Provide benchmark information for long-term trend analysis and correlation with other ambient monitoring programs within the State.

3. Determine which tributaries contribute the greatest pesticide load to Lower Wabash River Basin and Kankakee River Basin.

4. Compare pesticides loading from individual sampling sites.

STUDY AREA

LOWER WABASH RIVER BASIN

Location

The Wabash River originates in northwestern Ohio. After it crosses the Indiana state line, near New Corydon in Jay County Indiana, it cuts westward across the state then heads south eventually forming the border between Indiana and Illinois. For the ease of management the Indiana Department of Natural Resources divided the Wabash River into upper, middle, and lower subbasins. This project focuses on the Middle and Lower Wabash River Basin. This report will collectively describe these two subbasins as the Lower Wabash River Basin. This section of Lower Wabash River Basin includes Lafayette just down stream of the Wildcat Creek confluence down to the confluence of the Wabash River with the Ohio River (Greeman 1994).

Geology

The bedrock formations of the Lower Wabash River Basin are dominated by shale and sandstone from the Pennsylvanian age with small portions of the upper part of the basin represented by limestone, siltstone, sandstone, and shale dating to the Mississippian age, and limestone, dolomite, and black shale from the Devonian age. The parent material is mainly thick loess deposits to moderately thick loess over loamy glacial till. Along the main stem of the Wabash River the parent material is alluvial and outwash deposits. The topography for the lower two thirds of the basin is rolling plains underlain by loess, till, and bedrock; broad valley flats underlain by thick deposits of alluvium, outwash, and lake deposits. The northern third of the basin is described as having till plains and moraines of loam till, some southwest-oriented drainage troughs and outwash features, grades to dissected Wabash Valley region (IDNR 1980).

Land Use
The majority land use in the Lower Wabash River Basin is represented by 80% agricultural row crops and pastures.

Flow & Drainage
The Wabash River drains 32,910 mi^2 of Indiana, Illinois, and Ohio, and flows into the Ohio River. The Upper Wabash River Basin includes the Wabash River from beyond the Indiana-Ohio state line downstream to Lafayette. The Upper Wabash River Basin drains 7,278 mi^2 of which 285 mi^2 are in Ohio (Greeman 1994). The remainder of the basin from Lafayette to the mouth of the Wabash drains an additional 25,632 mi^2. The major tributaries that contribute to this section of the Wabash River are Prairie Creek, Sugar Creek, Big Raccoon Creek, the Vermilion River, Busseron Creek, Patoka River, White River, Embarrass River, and the Little Wabash River (IDNR 1980).

KANKAKEE RIVER BASIN

Location
The Kankakee River originates in north central Indiana near South Bend. It drains part of three states; Michigan, Indiana, and Illinois. This river flows in a westward direction for 104 miles towards the town of Kankakee, IL. From here the Kankakee River travels in a northwestward direction for 36 miles where it converges with the Des Plaines River to form the Illinois River. The Illinois River flows into the Mississippi River in the west central portion of Illinois. The total drainage area for the Kankakee River is 2,989 mi^2. The Indiana section of the basin has a drainage area of 2,169 mi^2. Michigan contributes only 7 mi^2 to the basin, leaving 813 mi^2 within the Illinois border. This project will only concern the Indiana section of the Kankakee River Basin.

Geology
The Kankakee River Basin's bedrock deposits are primarily limestone, dolomite, and black shale dating from the Devonian era, with smaller portions containing dolomite and limestone from the Silurian age, and limestone, siltstone, sandstone, and shale dating into the Mississippian age. The topography is basically split in half with low-lying sand and much outwash plain interspersed with sheet and dune, windblown sand, and morainic ridges in the northern section of the basin and plain with interspersed ice-disintegration forms, dunes, and lake flats in the southern half of the basin.

Land Use
The Kankakee River Basin contains about 8% of Indiana's land area (IDNR 1990). The land area is mostly represented by cropland with 89% of the land area represented with agricultural row crops and pastures.

Flow & Drainage
The Kankakee River drains 2,989 mi^2 of Indiana, Illinois, and Michigan. The Kankakee River

flows into Illinois where it converges with the Des Plaines River to form the Illinois River, which is part of the Mississippi River Drainage. The Kankakee River has the flattest streambed slope in Indiana averaging around 1 foot per mile. Some of the important tributaries to the Kankakee River are Little Kankakee River, Yellow River, Singleton Ditch, Mill Creek, Hodge Ditch, and Dehaan Ditch (IDNR 1990).

MATERIALS AND METHODS

SAMPLING LOCATIONS

Sampling locations were selected based on the presence of an active United States Geological Survey (USGS) gaging station. These gaging stations provided instantaneous flow values, which were needed for determining pesticide loading in streams. A complete list of the sampling locations, the number assigned to the USGS gaging station, and the individual drainage areas, in square miles from the Lower Wabash River and Kankakee River Basins are included in Tables 1 and 2.

Table 1 Lower Wabash River Basin Pesticides Sampling Locations at USGS Gaging Stations

Sampling Site	Station Location	USGS Gage #	Drainage Area mi^2
WLW040-0001	Wabash River @ Mt. Carmel, IL	03377500	28,635
WPA080-0002	Patoka River nr Princeton	03376500	822
WWL100-0005	White River @ Petersburg	03374000	11,125
WBU200-0003	Wabash River @ Vincennes	03343000	13,706
WBU160-0002	Busseron Creek nr Carlisle	03342500	228
WBU150-0002	Wabash River @ Riverton	03342000	13,161
WBU040-0003	Wabash River @ Terre Haute	03341500	12,263
WLV190-0003	Big Raccoon Creek nr Coxville	03341300	448
WLV150-0001	Wabash River @ Montezuma	03340500	11,118
WLV170-0003	Big Raccoon Creek nr Ferndale	03340900	222
WLV160-0002	Big Raccoon Creek nr Fincastle	03340800	139
WSU050-0006	Sugar Creek @ Crawfordsville	03339500	509
WLV080-0005	Wabash River @ Covington	03336000	8,218
WSU020-0004	Prairie Creek nr Lebanon	03339280	33
WLV010-0002	Wabash River @ Lafayette	03335500	7,278

Table 2 Kankakee River Basin Pesticides Sampling Locations at USGS Gaging Stations

Sampling Site	Station Location	USGS Gage #	Drainage Area mi^2
UMI040-0001	Iroquois River nr Foresman	05524500	449
UMI020-0002	Iroquois River nr Rosebud	05526000	36
UMK130-0001	Singleton Ditch nr Schneider	05519000	123
UMK110-0002	Kankakee River @ Shelby	05518000	1,779
UMK080-0001	Kankakee River @ Dunns Bridge	05517500	1,352
UMK040-0003	Kankakee River nr Davis	05515500	537
UMK060-0001	Yellow River @ Knox	05517000	435

Maps displaying the watersheds sampled and sampling locations in each basin are shown in Figures 1 and 2.

SAMPLING METHODOLOGY

Sampling consisted of collecting surface water grab samples from the center of flow at each station. The grab samples were collected on a weekly basis, approximately seven days apart. A sample collection apparatus was fabricated using two-four inch PVC pipes. The pieces of pipe were cut to the size of the sample bottles and then connected together by plastic bolts. A rope was attached to this apparatus and lowered from the bridge to collect water samples at each location. The sample containers for SAS5 (Modified EPA Test Method 525.2) were acid rinsed, glass, amber one-liter bottles. The apparatus was lowered and raised throughout the depth of the water column. After the samples were collected, the sampling apparatus and the outside of the sample bottles were decontaminated by rinsing with de-ionized water. Additionally at each site, 2- 40 mL vials preserved with thiosulfate were collected for EPA Test Method 547. All sample containers were also provided by the contract laboratory. Field data were collected at each site at the time of sampling with a Hydrolab®. It reported dissolved oxygen, pH, temperature, conductivity, and turbidity.

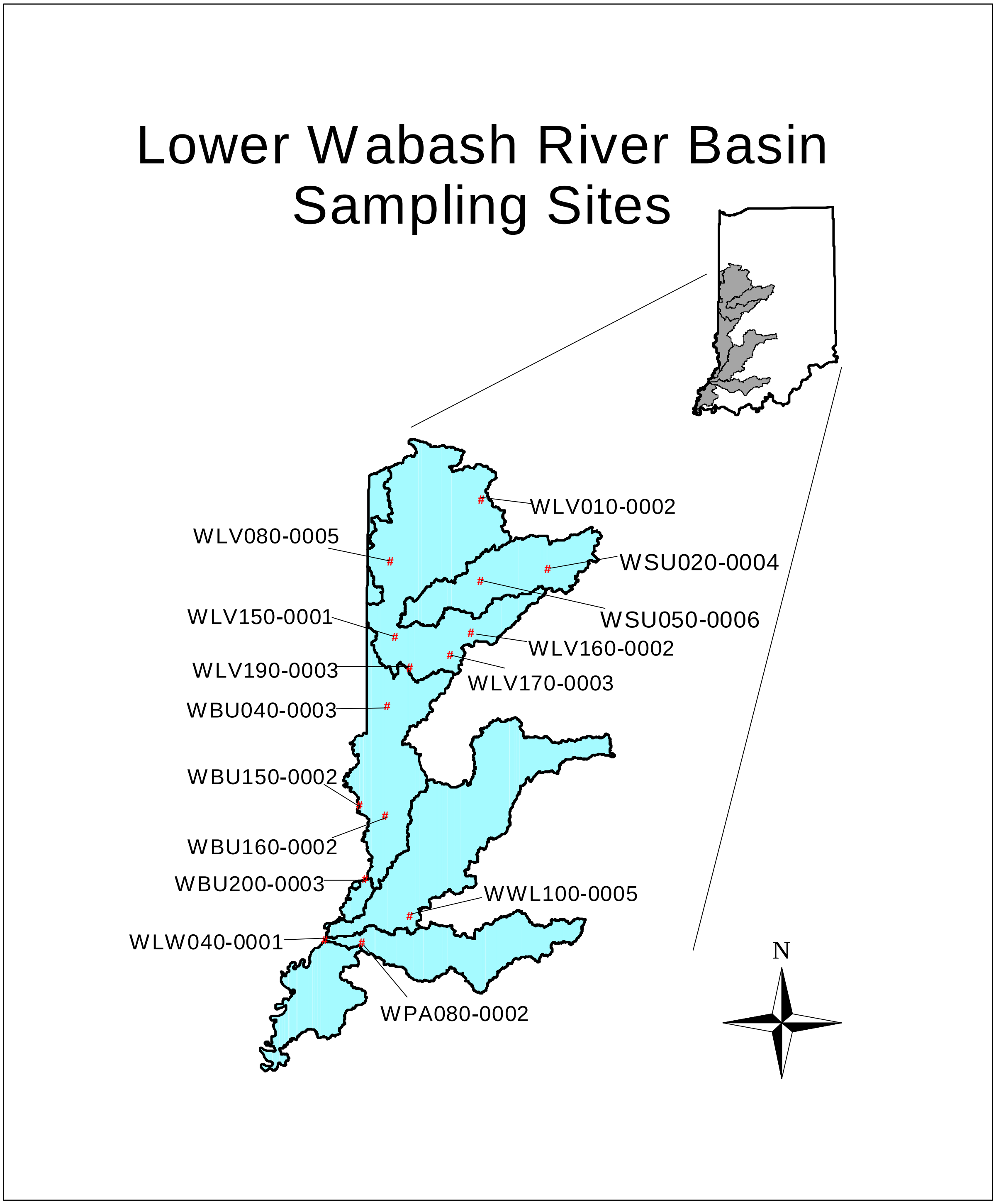

Figure 1 Sampling Sites in the Lower Wabash River Basin

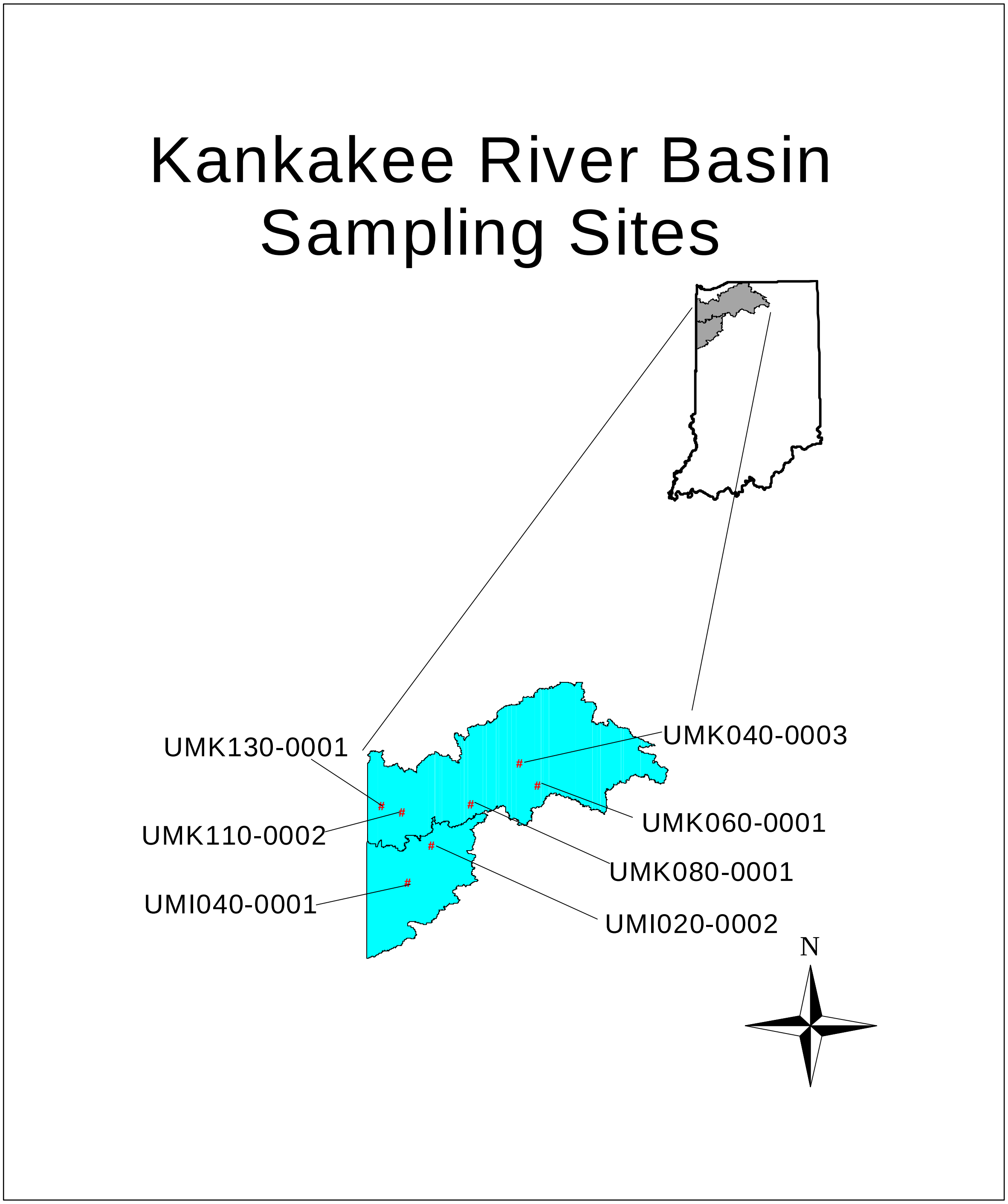

Figure 2 Sampling Sites in the Kankakee River Basin

CHEMICAL ANALYSIS

The 1-liter water samples were analyzed for 144 chemicals using SAS5 (Modified EPA Test Method 525.2), and the vials were analyzed for one chemical, glyphosate, using EPA Test Method 547. A detailed list of chemicals and pesticide constituents analyzed for this project is included in Tables 3 and 4. All samples were preserved by immediately placing the containers in a cooler of ice to maintain a temperature of 4°C. The vials were additionally pre-preserved with thiosulfate. All samples were delivered to a contract laboratory at the end of each week. Samples were not filtered before analysis.

QA/QC PROCEDURES

To ensure QA/QC requirements were met, a single duplicate water sample and a single Matrix Spike/Matrix Spike Duplicate were collected during each sampling route. All water sample results qualified for Data Quality Assessment (DQA) level 3 (Figure 3) according to the Quality Assurance Project Plan (QAPP) (Bowren and GhiasUddin 1999). Data falling under this category is considered as complete and is used for regulatory decisions.

Analytical results included QC check samples for each batch of samples from which precision, accuracy, and completeness were determined. Detection limits were determined using 40 CFR Part 136 Appendix B, Revision 1.11. Raw data, chromatograms, spectrograms, and bench sheets were not included as part of the analytical reports received by the Quality Assurance Officer, but have been maintained by the Contract Laboratory for easy retrieval and review.

Precision and Accuracy

Pesticide analysis precision is judged by laboratory duplicates, Matrix Spike (MS) and Matrix Spike Duplicates (MSD). A precision goal of +/-20% Relative Percent Difference (RPD) is expected to be met with for all pesticide analyses.

Quality assurance for analytical accuracy is based by comparison of % Recovery from MS/MSD samples. The accuracy goal is set by Environmental Health Laboratories using Laboratory Fortified Blank recovery control ranges for each parameter. The control ranges were derived from the mean and +/- 3 standard deviations of at least 30 data points, checked using the Grubbs Outlier Test.

Equipment Blanks

Non-contamination of equipment will be determined from equipment blank sample analysis. To accomplish equipment blanks reagent water was exposed to sampling equipment in the field. The equipment blanks will be used to assess for any contamination.

Table 3 Chemicals analyzed by SAS5 (Modified EPA Test Method 525.2)

CAS Number	Compound	Reporting Limits - µg/L
90-12-0	1-Methylnaphthalene	0.1
52663-71-5	2,2',3,3',4,4',6-Heptachlorobiphenyl	0.5
40186-71-8	2,2',3,3',4,5',6,6'-Octachlorobiphenyl	0.5
60233-25-2	2,2',3',4,6-Pentachlorobiphenyl	0.1
60145-22-4	2,2',4,4',5',6-Hexachlorobiphenyl	0.1
2437-79-8	2,2',4,4'-Tetrachlorobiphenyl	0.1
16605-91-7	2,3-Dichlorobiphenyl	0.1
15862-07-4	2,4,5-Trichlorobiphenyl	0.1
606-20-2	2,6-Dinitrotoluene	0.5
2051-60-7	2-Chlorobiphenyl	0.1
91-57-6	2-Methylnaphthalene	0.1
72-54-8	4,4'-DDD	0.1
72-55-9	4,4'-DDE	0.1
50-29-3	4,4'-DDT	0.1
208-96-8	Acenaphthylene	0.1
34256-82-1	Acetochlor	0.1
15972-60-8	Alachlor	0.1
309-00-2	Aldrin	0.1
319-84-6	Alpha-BHC	0.1
834-12-8	Ametryn	0.1
101-05-3	Anilazine	1
120-12-7	Anthracene	0.1
3244-90-4	Aspon	0.1
1610-17-9	Atraton	0.1
1912-24-9	Atrazine (Aatrex)	0.1
86-50-0	Azinphos-methyl	0.5
1861-40-1	Benfluralin	0.1
56-55-3	Benzo[a]anthracene	0.1
50-32-8	Benzo[a]pyrene	0.02
205-99-2	Benzo[b]fluoranthene	0.1
191-24-2	Benzo[g,h,i]perylene	0.1
207-08-9	Benzo[k]fluoranthene	0.1
319-85-7	Beta-BHC	0.1
35400-43-2	Bolstar	0.1
314-40-9	Bromacil	0.1
23184-66-9	Butachlor	0.1
2008-41-5	Butylate (Sutan Plus)	0.1
85-68-7	Butylbenzylphthalate	1
5234-68-4	Carboxin	0.1
5103-71-9	Chlordane, Alpha-	0.1
5103-74-2	Chlordane, Gamma-	0.1
510-15-6	Chlorobenzilate	0.1
2675-77-6	Chloroneb	0.1
1437871	Chloropropylate	0.1
1897-45-6	Chlorothalonil (Bravo)	0.1
101-21-3	Chlorpropham	0.1
2921-88-2	Chlorpyrifos	0.1
218-01-9	Chrysene	0.1
81777-89-1	Clomazone	0.1
56-72-4	Coumaphos	0.1
21725-46-2	Cyanazine (Bladex)	0.1
1134-23-2	Cycloate	0.1
1861-32-1	DCPA	0.1
319-86-8	Delta-BHC	0.1
298-03-3	Demeton O	0.5
6190-65-4	Desethylatrazine	1
1007-28-9	Desisopropylatrazine	1
103-23-1	Di(2-ethylhexyl)adipate	0.6
117-81-7	Di(2-ethylhexyl)phthalate	0.6
333-41-5	Diazinon	0.1
53-70-3	Dibenzo(a,h)anthracene	0.1
1194-65-6	Dichlobenil	0.1
97-17-6	Dichlofenthion	0.1
99-30-9	Dichloran	0.5
62-73-7	Dichlorvos	0.1
60-57-1	Dieldrin	0.1
84-66-2	Diethylphthalate	1
60-51-5	Dimethoate	0.5
131-11-3	Dimethylphthalate	1
84-74-2	Di-n-butyl Phthalate	2
117-84-0	Di-n-octyl Phthalate	2
957-51-7	Diphenamid	0.1
298-04-4	Disulfoton	0.1
218208	Disulfoton Sulfone	0.1
944-22-9	Dyfonate	0.1
959-98-8	Endosulfan I	0.1
33213-65-9	Endosulfan II	0.1
1031-07-8	Endosulfan sulfate	0.1
72-20-8	Endrin	0.01
7421-93-4	Endrin aldehyde	0.5
759-94-4	EPTC	0.1
55283-68-6	Ethalfluralin	0.1
563-12-2	Ethion	5
13194-48-4	Ethoprop	0.1
2593-15-9	Etridiazole	0.1
52-85-7	Famphur	0.1
22224-92-6	Fenamiphos	0.1
55-38-9	Fenthion	0.1
69806-50-4	Fluazifop-butyl	0.1

CAS Number	Compound	Reporting Limits - µg/L
33245-39-5	Fluchloralin	0.1
2164-17-2	Fluometuron	0.5
206-44-0	Fluoranthene	0.1
86-73-7	Fluorene	0.1
76-44-8	Heptachlor	0.04
1024-57-3	Heptachlor Epoxide	0.02
118-74-1	Hexachlorobenzene	0.1
77-47-4	Hexachlorocyclopentadiene	0.1
51235-04-2	Hexazinone	0.1
193-39-5	Indeno[1,2,3-cd]pyrene	0.1
78-59-1	Isophorone	0.1
21609-90-5	Leptophos	0.5
58-89-9	Lindane	0.02
121-75-5	Malathion	0.1
150-50-5	Merphos	0.1
72-43-5	Methoxychlor	0.1
950-35-6	Methyl Paraoxon	0.5
51218-45-2	Metolachlor	0.1
21087-64-9	Metribuzin	0.1
7786-34-7	Mevinphos	0.1
113-48-4	MGK 264, isomers a & b	0.1
136-45-8	MGK 326	0.1
2212-67-1	Molinate	0.1
6923-22-4	Monocrotophos	0.5
91-20-3	Naphthalene	0.1
15299-99-7	Napropamide	0.1
19666-30-9	Oxadiazon	0.1
1114-71-2	Pebulate	0.1
40487-42-1	Pendimethalin	0.1
87-86-5	Pentachlorophenol	1
61949-76-6	Permethrin, cis	0.1
51877-74-8	Permethrin, trans	0.1
85-01-8	Phenanthrene	0.1
298-02-2	Phorate	0.1
26399-36-0	Profluralin	0.1
1610-18-0	Prometon	1
7287-19-6	Prometryn	0.1
23950-58-5	Pronamide	0.1
1918-16-7	Propachlor	0.1
709-98-8	Propanil	0.5
139-40-2	Propazine	0.1
129-00-0	Pyrene	0.1
122-34-9	Simazine	0.07
1014-70-6	Simetryn	0.1
22248-79-9	Stirofos	0.1
5902-51-2	Terbacil	0.1
13071-79-9	Terbufos	0.5
886-50-0	Terbutryn	0.1
28249-77-6	Thiobencarb	0.1
297-97-2	Thionazin	0.5
39765-80-5	trans-Nonachlor	0.1
43121-43-3	Triadimefon	0.5
78-48-8	Tribufos	0.1
1582-09-8	Trifluralin	0.1
1929-77-7	Vernolate	0.1

Table 4 Chemicals analyzed by EPA Test Method 547

CAS Number	Compound	Reporting Limits - µg/L
1071-83-6	Glyphosate	6.0

SELECTED PESTICIDE NARRATIVES

Table 5 lists the ten most commonly used pesticides in Indiana along with their brand names, target crop, MCL, and the number of times that the pesticide was identified above the minimum reporting limit and the number of times it exceeded the Finished Drinking Water MCL.

The National Agricultural Statistics Service (NASS) reports that 6.67 million pounds of atrazine, 3.84 million pounds of metolachlor, 2.94 million pounds of acetochlor, and 0.45 million pounds of chlorpyrifos were applied to 5.8 million acres of corn in Indiana during 1999. In addition, 4.43 million pounds of glyphosate, 0.22 million pounds of metolachlor, 0.18 million pounds of 2,4-D were applied to 5.6 million acres of soybeans in 1999 (NASS 2000). Figure 3 represents the data provided by NASS by listing the percent of individual pesticide pounds to the sum of all applied pesticide pounds.

Further details and a limited list of their associated brand names for the ten most commonly used pesticides are discussed in the following text.

ATRAZINE

Brand Name(s): AATREX, BICEP, EXTRAZINE, BULLET, LARIAT, SURPASS and GUARDSMAN

Atrazine, a triazine derivative (Carter, Lydy, and Crawford 1995), is a restricted use pesticide with a toxicity rating of III (moderately toxic). Atrazine has been produced by Syngenta (formally Novartis, which was formally Ciba Corporation) since 1958. It is used as a preemergent and postemergent herbicide to control broadleaf and grassy weeds for corn production. Atrazine is used to kill weeds by inhibiting the photosynthetic process in targeted plants. The soil absorption is moderate, and the biological degradation for aerobic conditions is about 146 days and 159 days for anaerobic conditions. The persistence of atrazine in the field is about 60 days, making this a very effective herbicide, but it can persist in the soil for more than a year in arid environmental conditions and high soil pH (Ahrens 1994). Atrazine was the most used pesticide in Indiana, with an estimated 6.67 million pounds applied to 91% of the 5.8 million acres of corn at an application rate of 1.26 pounds per acre in1999 (NASS 2000). Atrazine is listed in the Federal Register's Water Quality Criterion with an acute criterion of 350 ug/L and a chronic criterion of 12 ug/L (Federal Register 2001). It is considered a possible human carcinogen. It has been found to cause tumors in mammary glands and other reproductive organs in laboratory animals, and has a low-level bioaccumulation in fish. It has been categorized as a possible endocrine disruptor (ORSANCO 1997).

Table 5 Most Commonly Used Pesticides and Associated Information

Common Name	Brand Name	Crop receiving treatment	MRL*/ MCL**
Acetochlor	Harness and Surpass	Corn	0.1ug/L 2 ug/L
Atrazine	Aatrex	Corn and Sorghum	0.1 ug/L 3 ug/L
Chlorpyrifos	Dursban, Empire, Lorsban, Brodan, Detmol UA	Can be used on all types of crops	0.1 ug/L NA
Clomazone	Command, Commence, and Merit	Soybean	0.1 ug/L NA
Cyanazine	Bladex and Fortrol	Corn, Sorghum, wheat	0.1ug/L NA
Glyphosate	Roundup, Rodeo, Landmaster, Sting	Soybean	6.0 ug/L 700 ug/L
Metolachlor	Dual and Pennant	Corn, Soybeans, Potatoes and Sorghum	0.1 ug/L NA
Pendimethalin	Prowl, Squadron, Stomp	Soybean	0.1 ug/L NA
Terbufos	Aragran, Conrtaven, Counter, and Plydox	Corn	0.1 ug/L 0.2 NA
2,4-D	Justice, Lawn-Keep, Miracle	Soybean	NA 70 ug/L

*Minimum Reporting Limit (MRL) is established by the contract laboratory as the lowest analyte concentration that can be quantified and reported by the laboratory. The MRL is set at or above the lowest calibration standard which is included in all analyses.
**Maximum Contaminant Level (MCL) is for finished drinking water. Currently there are no surface water standards established for the listed pesticides in unfinished surface water. The MCL is presented as a reference point for this study.

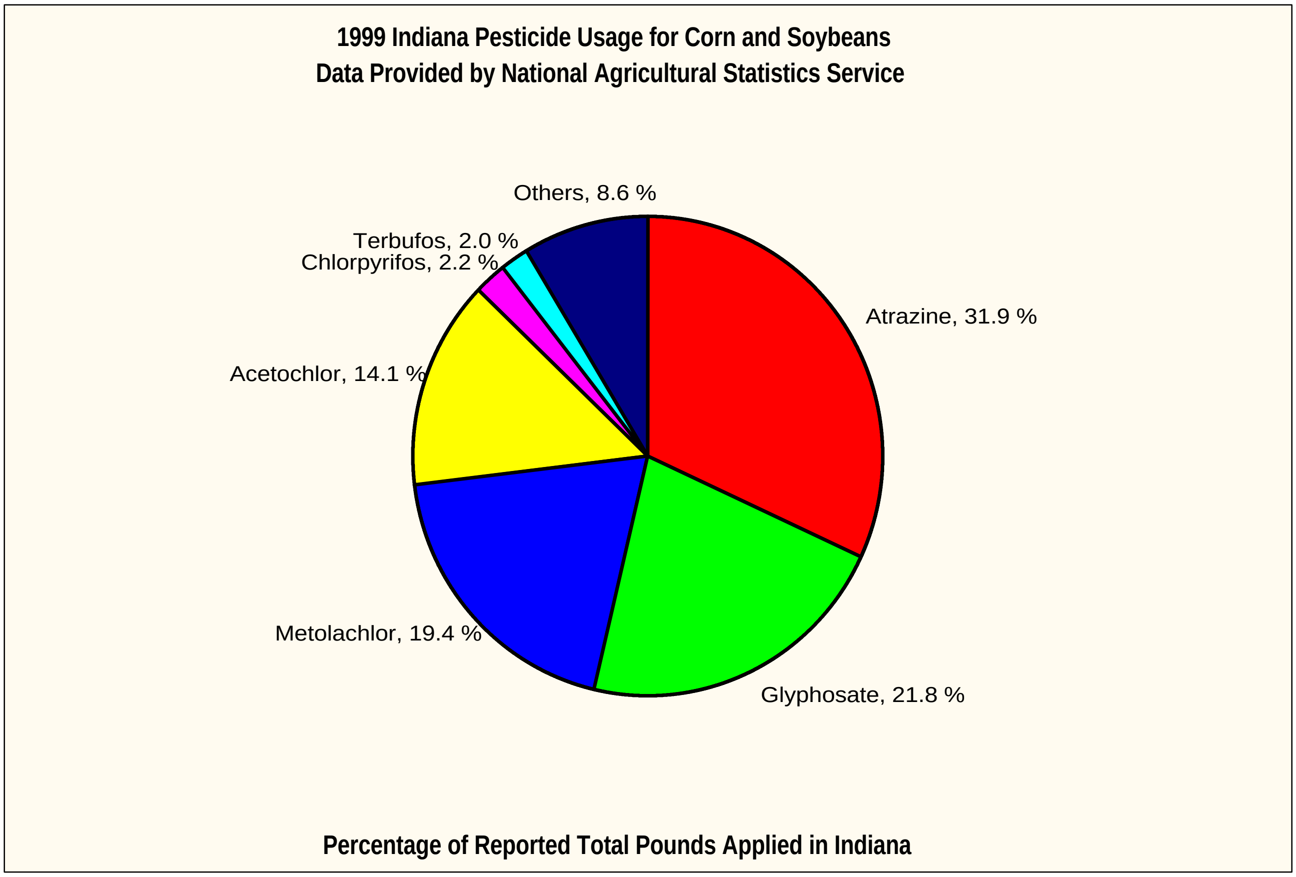

Figure 3 Percentage of Pounds of Selected Pesticides Applied to Corn and Soybeans for Indiana

GLYPHOSATE

Brand Name(s): SILHOUETTE, RATTLER, ROUNDUP, RODEO and TOUCHDOWN

Glyphosate is a general use pesticide and is not part of any accepted chemical family. It has a toxicity rating of II (very toxic). Glyphosate is manufactured by several companies including Monsanto, Cenex/Land O⁃Lakes, Helena and Zeneca. Glyphosate is usually mixed with a salt and another herbicide to create an effective product. It is used as both a preemergent and a postemergent herbicide. Glyphosate is a broad-spectrum, non-selective systemic herbicide used for control of annual and perennial plants including grasses, sedges, broad-leaved weeds, and woody plants. It rapidly absorbs to all soils, degrades microbially in soil and has a low potential for movement by runoff in field and lab studies (Ahrens 1994). About 4.43 million pounds of glyphosate were applied to 76% of the 5.60 million acres of soybeans at an application rate of 1.04 pounds per acre, and about 0.14 million pounds of glyphosate were applied to 5% of 5.8 million acres of corn at an application rate of 0.47 pounds per acre in 1999 (NASS 2000).

METOLACHLOR

Brand Name(s): DUAL

Metolachlor, a chloroacetamide class of herbicide (Carter, Lydy, and Crawford 1995), is a general use pesticide, and has a class III toxicity rating. It can be a restricted use pesticide when paired with atrazine or cyanazine. Ciba Corporation, now known as Syngenta, first produced metolachlor in 1972. It is applied as a preemergent as well as a postemergent herbicide to control broadleaf weeds, grasses, and yellow nutsedge in corn and soybean fields for about 10-14 weeks. Metolachlor is moderately absorbed to soil and prefers muck, clay and organic matter. The compound's photo degradation period is about 70 days. It aerobically degrades in about 67 days and anaerobically in 81 days (Ahrens 1994). Metolachlor was the third most used pesticide in Indiana (NASS 2000). There was an estimated 3.84 million pounds applied to 47% of the 5.8 million acres of corn at an application rate of 1.41 pounds per acre, and an additional 0.22 million pounds applied to 2% of the 5.6 million acres of soybeans at an application rate of 1.95 pounds per acre in 1999.

ACETOCHLOR

Brand Name(s): HARNESS, GUARDIAN, and SURPASS

Acetochlor, manufactured by Monsanto and Zeneca, is a restricted use pesticide and has a toxicity class rating I (highly toxic). Acetochlor is a member of the chloroacetamide chemical family. It is used to control grasses, some broadleaf weeds, and yellow nutsedge in corn. The U.S. Environmental Protection Agency (USEPA) conditionally registered acetochlor in 1994. This was due to the broad-spectrum weed control provided by acetochlor and low labeled use rates. The USEPA expects that use of acetochlor will significantly reduce total amounts of herbicides used in the United States. The continued registration of acetochlor is conditional based on the targeted use reductions of the herbicides alachlor, atrazine, butylate, EPTC, metolachlor, and 2,4-D. Acetochlor has chemical properties similar to alachlor and metolachlor, and has been classified by the USEPA as a probable human carcinogen.

Registration of acetochlor will be canceled automatically if there is a violation of any of the following conditions:

- reductions in the use of other broad-spectrum herbicides are not met
- measured concentrations of acetochlor in groundwater consistently exceed 0.1 micrograms per liter (ug/L) at a large number of wells or
- exceed 1.0 ug/L in groundwater at a small number of wells.

Also the annual average concentration of acetochlor cannot exceed 2.0 ug/L in the surface water supply of a specified number of community water systems (Crawford 1997).

Acetochlor is readily absorbed by soil and is degraded by microbes. Generally, acetochlor provides 8-12 weeks of preemergent weed control, but can vary depending on soil type and weather conditions (Ahrens 1994). Rainfall totals of 0.3-0.6 inches will activate acetochlor 7-10 days after application, and it is most active on heavy or high organic matter soils (Thomson 1993). Acetochlor was the fourth most used pesticide in Indiana during 1999 with 2.94 million pounds applied. Based on the recent USGS report on acetochlor and statistics from NASS, the use of acetochlor over the past several years has increased. In 1997 NASS reported acetochlor was used on only 15% of 6 million corn acres of Indiana. Acetochlor was applied to 31% of the 5.80 million corn acres planted at an application rate of 1.64 pounds per acre in 1999 (NASS 2000).

CHLORPYRIFOS

Brand Name(s): DURSBAN, LORSBAN, BRODAN, DETMOL UA, DOWCO 179, EMPIRE, ERADEX, PAQEANT, PIRIDANE, SCOUT, and STIPEND.

Chlorpyrifos, a general use pesticide depending on the toxicity of the formulation. It belongs to the organophosphate chemical family, and has a toxicity class of II. The manufacturer of chlorpyrifos is Dow Agra

Chlorpyrifos is a broad-spectrum organophosphate insecticide. It was originally used to control mosquitoes, it is no longer registered for that use. It is an effective control for cutworms, corn rootworms, cockroaches, grubs, flea beetles, flies, termites, fire ants, and lice. It is used in agricultural, lawns and ornamental settings. It is also applied to livestock, domestic dwellings, and commercial establishments as an insecticide. It is primarily a contact poison, with some action as a stomach poison. It was the fith most used pesticide in 1999 with 0.45 million pounds applied to 7% of the 5.8 million acres of corn at an application rate of 1.12 pounds per acre (NASS 2000).

TERBUFOS

Brand Name(s): ARAGRAN, CONTRAVEN, COUNTER, and PLYDOX

Terbufos, a member of the organophosphate chemical family, is a restricted use pesticide only in products with 15% or more active ingredient. It is classified as toxicity class I, highly toxic. Terbufos is an insecticide and nematicide used on corn. It is used to control wireworms, seedcorn maggots, white grubs, corn rootworm larvae, and other pests. Terbufos is extremely toxic to birds, mammals, fish, and aquatic invertebrates. There is no known effects on the reproductive systems or teratogenic, mutagenic, or carcinogenic effects to laboratory animals. Terbufos is moderately persistent in soil. Degradation is rapid in the first 15-30 days after application. It dissipates quicker in soils with very low organic carbon. Soil temperature increases the time of degradation, and soil moisture has no effect on terbufos. It is generally immobile and is therefore unlikely to leach out of the area applied. In one study, over 90% of the applied terbufos was recovered in the top 4 inches of a soil profile despite heavy rainfall (Oregon State University 1996). Terbufos was the sixth most used pesticide in 1999. It was applied to 8% of the 5.8 million acres totaling 0.42 million pounds at an application rate of 0.91 pounds per acre (NASS 2000).

PENDIMETHALIN

Brand Name(s): PROWL, PURSUIT, SQUADRON, SOUTHERN WEEDGRASS CONTROL and ORNAMENTAL HERBICIDE II

Pendimethalin, a member of the dinitroaniline chemical family (Carter, Lydy, and Crawford 1995), is a general use pesticide and is manufactured by two companies, American Cyanamid and Scotts. It has a toxicity rating of III. The intended use of the chemical is for controlling grasses and certain broadleaf weeds. It is used in both preemergent and postemergent applications. Pendimethalin can be applied in liquid fertilizer, or impregnated on dry bulk fertilizer. This compound is strongly absorbed by clay and organic matter. Degradation is rapid under anaerobic conditions and slow under aerobic conditions. Pendimethalin is immobile when strongly bound to clay and organic matter. Most pendimethalin washed into surface water via sediment will remain bound to sediment and unavailable to aquatic life (Ahrens 1994). Approximately 0.36 million pounds of pendimethalin was applied to 8% of the 5.60 million acres of soybeans at an application rate of 0.81 pounds per acre in 1999 (NASS 2000). Pendimethalin was not detected during the study. It was the seventh most used pesticide in 1999.

CYANAZINE

Brand Name(s): BLADEX

Cyanazine is a restricted use pesticide and is part of the triazine chemical family (Carter, Lydy, and Crawford 1995) with a toxicity rating of III. Cyanazine was developed by DuPont in 1971 for use on corn to control broadleaf and grassy weeds. Cyanazine is the eighth most used herbicide in Indiana, with an estimated 0.32 million pounds applied to 3% of the 5.8 million acres of corn in Indiana at an application rate of 1.89 pounds per acre in 1999 (NASS 2000). DuPont has agreed to phase out cyanazine completely in response to a special review of the herbicide by the USEPA concerning chronic cyanazine exposure and the risk of cancer, occurrence in groundwater, and its teratogenicity. The manufacturer chose to phase out cyanazine voluntarily due to the costly review process. The phase out will begin by reducing the manufacturer’s recommended application rates. All sales and distribution by DuPont were banned December 31, 1999. Retailers will be permitted to sell existing stocks through September 1, 2002, with all use prohibited after December 31, 2002 (ORSANCO 1997).

Cyanazine inhibits photosynthesis of broadleaf weeds and several grasses. It can be used as a preemergent or postemergent herbicide. Cyanazine's absorption increases when water content in soil is low and organic matter is high (Ahrens 1994). Cyanazine is part of the triazine family along with simazine and atrazine. This corn herbicide is not used nearly as much as atrazine but is still an effective herbicide.

2,4-D

Brand Name(s): TILLER, NAVIGATE, CLASS, WEED-PRO 4 AMINE, JUSTICE, WARRANT, BARRAGE, and CAMPAIGN

2,4-D is a general use pesticide with a toxicity rating of III, and belongs to the chlorinated phenoxy chemical family (Carter, Lydy, and Crawford 1995). It is a foliar-applied herbicide used to control many broadleaf weeds such as pigweed, ragweed, cocklebur and others with little or no activity against grasses. It is also labeled for aquatic weed control, specifically for Eurasian water milfoil, water hyacinth, bulrush, bladderwort, and water lily. 2,4-D is exclusively used for postemergent applications. Many different companies manufacture 2,4-D. They include AgrEvo, AGSCO, Applied Biochemists, Cenex, Cornbelt, DowElanco, Farmland, Helena, Monsanto and others.

2,4-D undergoes degradation via microbial breakdown in warm, moist soil. The rate of breakdown increases with increased temperatures and moisture. The average field half-life is 10 days. There is a potential for mobility, but rapid degradation in soil and removal from soil by plant uptake minimizes leaching (Ahrens 1994). Approximately 0.17 million pounds of 2,4-D were applied to 8% of the 5.60 million acres of soybeans at an application rate of 0.39 pounds per acre. An additional 0.12 million pounds was applied to 6% of the 5.80 million acres of corn planted in 1999 with an application rate of 0.34 pounds per acre (NASS 2000). 2,4-D was not included among the analytes in the test method used for this study.

RESULTS AND DISCUSSIONS

This pesticides monitoring report is based on the following assumptions.

1. All conclusions are based on a sampling frequency of a seven-day cycle.
2. Land use coverage is based on U.S. Geological Survey 1994 publication (USGS 1994).
3. Loading calculations were made assuming concentrations and flow rates remained constant throughout the day.

RESULTS

Analytical results for individual chemicals detected above the Minimum Reporting Limit (MRL) from SAS5 (Modified EPA Test Method 525.2) from each sampling location and sampling event are listed in Appendix A. There is no data reported for EPA Test Method 547 due to no detection above the MRL. All field data (date, time, DO, pH, temperature, specific conductance, turbidity, and flow) are in Appendix B.

Among the 145 toxic chemicals analyzed, only seventeen were detected. Of the seventeen chemicals detected eleven were herbicides (acetochlor, alachlor, atrazine, bromacil, clomazone, cyanazine, metolachlor, metribuzin, prometryn, simazine, and terbutryn), two were fungicides (chloroneb and chlorothalonil), one insecticide (gamma-BHC), and three industrial chemicals (di-n-butylphthalate, di(2-ethylhexyl)phthalate, and dimethylphthalate). The three chemicals that were detected most often were all herbicides. These three herbicides were atrazine, acetochlor, and metolachlor.

QUALITY ASSURANCE MEASUREMENTS

In-lab data quality assurance or analytical precision was based on laboratory duplicates, Matrix Spike, Matrix Spike Duplicates, and Relative Percent Difference (RPD). The overall precision based on average RPD for all the analyses, was 6.2% which was within the +/-20% acceptable required limits. The analytical precision data for acetochlor, atrazine, and metolachlor is listed in Table 6.

In-lab data analytical accuracy was based by comparison of percent recovery from MS/MSD samples. The accuracy goal was set by Environmental Health Laboratories using Laboratory Fortified Blank recovery control ranges for each parameter. The control ranges were derived from the mean and +/-3 standard deviations of at least 30 data points, checked using the Grubbs Outlier Test. The overall percent recovery was 103.4%. The analytical accuracy data for acetochlor, atrazine, and metolachlor is included in Table 7. The analytical performance for this project based on the precision and accuracy in the Environmental Health Laboratories analytical laboratory demonstrated that analytical data generated for this project was precise and could be used for any regulatory or water quality management decisions.
Field data quality of field sampling techniques were monitored with the equipment or source blanks and field duplicates. The quality control data, showed that the overall precision expressed as Relative Percent Difference of the field duplicates was 29.2%. This data is included in Table 6.

Figure 4 defines the four levels of Data Quality Assessment (DQA). All laboratory data for this project met DQA Level 3.

Table 6 Precision Measured in Duplicate Samples

		Acetochlor		Atrazine		Metolochlor	
Survey Week	**EHL Report #**	**Field Dupl RPD(1)**	**MS/MSD(2) % RPD(1)**	**Field Dupl RPD(1)**	**MS/MSD(2) % RPD(1)**	**Field Dupl RPD(1)**	**MS/MSD(2) % RPD(1)**
04/05/99	400886-933	*	**	*	6.2	*	2.5
04/26/99	405874-924	200.0	5.2	81.5	**	28.6	**
05/03/99	407406-56	0.0	**	61.5	0.5	0.0	3.9
05/10/99	408689-738a	0.0	**	0.0	**	0.0	**
05/17/99	410399-449	22.2	5.0	10.5	**	11.8	**
05/24/99	411730-780	0.0	**	6.5	4.2	0.0	4.8
05/31/99	413307-357	0.0	**	13.3	**	0.0	**
06/07/99	414855-905	0.0	**	200.0	**	0.0	**
06/14/99	416991-7041	0.0	16.7	83.9	3.6	46.2	23.0
06/21/99	418668-718	0.0	**	14.3	**	200.0	**
06/28/99	420419-69	0.0	5.1	0.0	3.5	0.0	3.4
07/05/99	421947-97	0.0	**	62.1	**	18.2	**
07/12/99	423348-98	*	10.4	*	11.5	*	8.8
07/19/99	424797-847	0.0	**	33.3	**	0.0	**
07/26/99	426551-601	0.0	2.1	28.6	0.7	15.4	1.9
	Parameter Average	17.1	7.4	45.8	4.3	24.6	6.9
	Study Average	29.2	6.2	29.2	6.2	29.2	6.2

(1) Relative Percent Difference

(2) Matrix Spike/Matrix Spike Duplicate

* indicates field duplicate sample either not collected or lost

** indicates parameter not included in the MS/MSD spike added by the laboratory

Table 7 Accuracy Measured in Spiked Samples

		Acetochlor		Atrazine		Metolochlor	
Survey Week	**EHL Report #**	**MS[1] % Recov**	**MSD[2] % Recov**	**MS % Recov**	**MSD % Recov**	**MS % Recov**	**MSD % Recov**
04/05/99	400886-933	**	**	89.3	95.1	93.9	96.3
04/26/99	405874-924	109.6	116.2	**	**	**	**
05/03/99	407406-56	**	**	103.5	102.5	104.8	110.0
05/10/99	408689-738a	**	**	**	**	**	**
05/17/99	410399-449	97.9	102.9	**	**	**	**
05/24/99	411730-780	**	**	93.3	108.7	93.7	99.1
05/31/99	413307-357	**	**	**	**	**	**
06/07/99	414855-905	**	**	**	**	**	**
06/14/99	416991-7041	78.5	99.5	99.9	112.3	84.3	108.0
06/21/99	418668-718	**	**	**	**	**	**
06/28/99	420419-69	83.3	88.4	103.6	111.0	100.2	103.8
07/05/99	421947-97	**	**	**	**	**	**
07/12/99	423348-98	105.5	94.8	121.2	105.7	103.4	94.7
07/19/99	424797-847	**	**	**	**	**	**
07/26/99	426551-601	121.8	119.4	119.9	120.8	118.1	120.4
	Parameter Average	99.4	103.5	104.4	108.0	99.8	104.6
	Study Average	101.3	105.5	101.3	105.5	101.3	105.5

(1) Matrix Spike
(2) Matrix Spike Duplicate
** indicates parameter not included in the MS/MSD spike added by the laboratory

Data Quality Level	Description
Level 1 **Screening data**	The results are usually generated onsite and have no QC checks. Analytical results, which have no QC checks or no precision or accuracy information or no detection limit calculations, but just numbers, are included in this category. Primarily, onsite data are used for presurveys and for preliminary rapid assessment.
Level 2 **Field analysis data**	Data is recorded in the field or laboratory on calibrated or standardized equipment. Field duplicates are measured on a regular periodic basis. Calculations may be done in the field or later at the office. Analytical results, which have limited QC checks, are included in this category. Detection limits and ranges have been set for each analysis. The QC checks information for field or laboratory results is useable for estimating precision, accuracy, and completeness for the project. Data from this category is used independently for rapid assessment and preliminary decisions.
Level 3 **Laboratory analytical data**	Analytical results include QC check samples for each batch of samples from which precision, accuracy, and completeness can be determined. Detection limits have been determined using <u>40 CFR Part 136 Appendix B, Revision 1.11.</u> Raw data, chromatograms, spectrograms, and bench sheets are not included as part of the analytical report, but are maintained by the Contract Laboratory for easy retrieval and review. Data can be elevated from level 3 to level 4 by the inclusion of this information in the report. In addition, level 4 QC data must be reported using CLP forms or CLP format. Data falling under this category is considered as complete and is used for regulatory decisions.
Level 4 **Enforcement data**	*Analytical results mostly meet the USEPA required Contract Laboratory Program (CLP) data analysis, contract required quantification limits (CRQL), and validation procedures.* QC data is reported on CLP forms or CLP format. Raw data, chromatograms, spectrograms, and bench sheets are included as part of the analytical report. Additionally, all reporting information required in the IDEM/BAA and in the Surface Water QAPP Table 11-1 are included. Data is legally quantitative in value, and is used for regulatory decisions.

Figure 4 Data Quality Assessment Levels

GENERAL OBSERVATIONS

The goal of this project was to detect the presence of selected pesticides, establish their respective concentrations, and calculate loading in surface waters of the Lower Wabash River and the Kankakee River Basins. Using this information and estimated herbicide application for the watersheds a percent runoff can be established. The percent runoff will vary due to many factors such as agricultural practices, soil characteristics, chemical characteristics of the pesticide, size of watershed, and the amount of time between the pesticide application and a major rainfall event.

Due to the frequent detection of atrazine, acetochlor, and metolachlor, this report is limiting the discussion to these three herbicides. These three herbicides were also the most used agricultural pesticides in Indiana during 1999 (NASS 2000). The average concentrations, of the three herbicides are, in respective order, 3.03 ug/L, 0.64 ug/L, and 1.28 ug/L. Atrazine was the most commonly detected herbicide with 257 detections above the Minimum Reporting Limit (MRL). The average concentration of atrazine for the entire survey was 3.03 ug/L. A maximum concentration of atrazine was 89 ug/L on April 5, 1999 in the Wabash river at Mt. Carmel (WLW040-0001) (Appendix A-10 & Figure 24). Acetochlor had 84 detections above the MRL, and a maximum concentration of 3.2 ug/L at Busseron Creek (WBU160-0002) on May 24, 1999 (Appendix A-4 & Figure 17). The average concentration of acetochlor for the survey was 0.64 ug/L. Metolachlor had 132 detections above the MRL and a peak concentration of 55ug/L at Prairie Creek near Lebanon (WAU020-0004), on April 6, 1999 (Appendix A-13 & Figure 18). The average concentration of metolachlor for the survey was 1.28 ug/L. For more complete information on the pesticides found in this project refer to Appendix A.

The average runoff rates for the three respective herbicides are as follows; atrazine, 1.14%; acetochlor, 0.49%; and metolachlor, 1.20%. A study on the White River Basin by the USGS indicated a percent runoff of 1% (Carter, Lydy, and Crawford 1995). Studies published by McDuffee (2001) and Grady (1998) found simular runoff percentages. Individual watersheds do have varying results and are discussed more fully in RUNOFF CALCULATIONS.

LOADING CALCULATIONS

To calculate loading, multiply the concentration of a specific herbicide by the flow rate at the time of sample then multiply by the conversion factor 0.0053945. The conversion factor converts the concentration (ug/L) and flow rate (ft^3/s) to one value (lbs/day). The conversion equation and an example are located in Figure 5. The example conversion is taken from the Iroquois River site UMI020-0002 on April 29, 1999. The concentration for atrazine was 0.7 ug/L and the flow was 67.2 ft^3/s.

$$\frac{28.3\ \text{L}}{1\ \text{ft}^3} \times \frac{\mu\text{g}}{\text{L}} \times \frac{1\ \text{ft}^3}{\text{sec}} \times \frac{3600\ \text{sec}}{\text{hr}} \times \frac{24\ \text{hrs}}{\text{Day}} \times \frac{1\ \text{g}}{1.0^6\text{ug}} \times \frac{.035302\ \text{oz}}{\text{g}} \times \frac{1\ \text{lbs}}{16\ \text{oz}} = 5.3945\text{x}10^{-3}$$

Example

0.7 ug/L*67.2 ft^3/s*0.0053945= 0.254 lbs/day

Figure 5 Loading Conversion Equation and Example

The true shape of the function describing the load per unit time is not known due to fluctuating flow rates and pesticide concentrations. Instead, the function available consists of discrete points spaced roughly one week apart, with one load observation about seven days prior to the following observation. As a result, it is not possible to integrate the true function to find the total mass of any particular chemical that ran off into the stream.

In cases like this, other methods are available to approximate the integral. One of these methods is known as the Trapezoid Rule. An example graph of this rule can be seen in Figure 6. This method calculates the area under the load function by creating *n-1* trapezoids for *n* observations where the area if each trapezoid is $(l_1 + l_2)/2 * w$. The lengths of the legs of the trapezoids are the magnitude of the successive load observations, and the widths of the trapezoids are the intervals of time. By summing all of the trapezoids, the total pounds of chemical contributed by runoff into the stream or river is approximated for each sampling station. These calculations were used to construct Tables 8 through 13 where pound loadings for the river basins are presented.

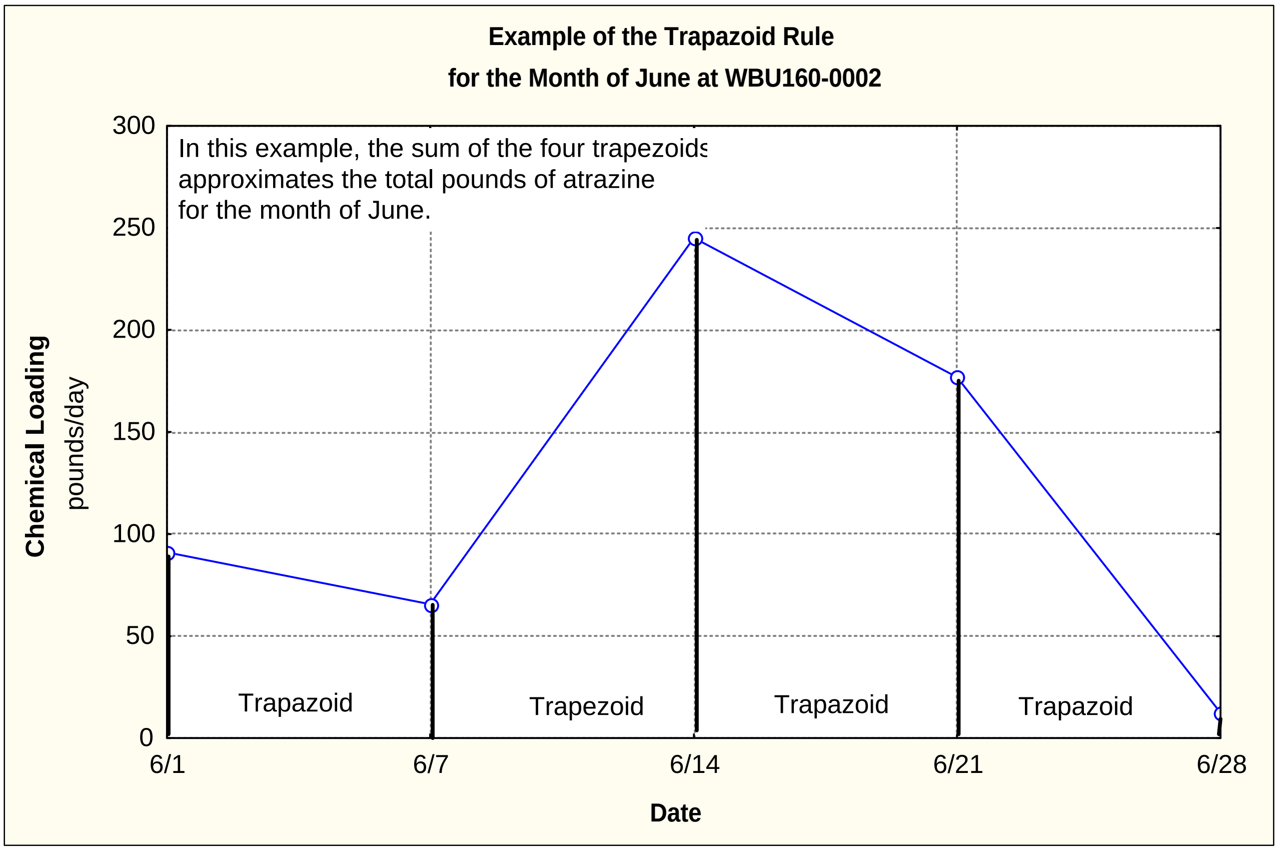

Figure 6 Example of the Trapezoid Rule

Table 8 Pounds per Day of Atrazine for the Wabash River and White River Sample Sites

Sample Week	WLV010-0002	WLV080-0005	WLV150-0001	WBU040-0003	WBU150 -0002	WBU200 -0003	WWL100-0005	WLW040-0001
04/05/99	0	0	0	0	0	646.03	174.78	17236.0
04/26/99	43.372	80.92	100.07	122.563	0	264.11	245.45	581.15
05/03/99	12.267	21.43	25.08	45.098	52.219	69.43	89.01	230.61
05/10/99	0	0	19.16	35.927	28.051	28.07	0	129.63
05/17/99	77.638	27.82	50.35	95.483	480.7	506.22	78.04	475.79
05/24/99	301.553	114.64	111.99	217.129	140.04	177.99	440.19	1008.6
05/31/99	398.761	459.18	183.07	88.901	292.73	884.16	65.04	304.41
06/07/99	46.738	124.84	154.39	292.652	540.96	838.08	239.95	3223.8
06/14/99	144.163	88.47	182.28	84.095	215.56	200.71	112.98	719.52
06/21/99	22.576	37.5	53.51	71.919	0	118.82	45.00	214.32
06/28/99	18.708	22.51	35.54	27.512	34.741	73.62	86.31	420.02
07/05/99	21.114	19.18	17.62	17.608	22.7	28.38	33.77	97.91
07/12/99	9.732	11.22	7.06	15.051	14.765	9.86	15.18	41.16
07/19/99	14.954	9.44	14.41	10.649	15.32	14.37	8.97	27.11
07/26/99	7.552	7.72	8.38	10.724	13.896	15.49	12.5	28.77

Note: Pounds per day=(concentration)(flow)(.0053945)

Table 9 Pounds per Day of Metolachlor for The Wabash River and White River Sample Sites

Sample Week	WLV010-0002	WLV080-0005	WLV150-0001	WBU040-0003	WBU150 -0002	WBU200 -0003	WWL100-0005	WLW040-0001
04/05/99	0.00	0.00	0.00	0.00	0.00	76.35	0.00	0.00
04/26/99	21.69	40.46	57.18	61.28	0.00	123.25	47.2	244.70
05/03/99	8.18	10.71	16.72	33.82	39.16	41.66	40.46	102.50
05/10/99	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
05/17/99	19.41	0.00	20.14	38.19	121.97	110.05	0.00	108.80
05/24/99	69.59	34.89	39.20	49.63	31.83	34.23	55.02	146.00
05/31/99	156.66	143.49	45.77	26.67	78.41	136.64	0.00	67.65
06/07/99	12.30	29.57	40.03	94.40	164.64	226.15	52.49	725.30
06/14/99	45.23	28.31	35.28	0.00	23.30	34.61	26.58	88.36
06/21/99	0.00	7.14	13.38	22.88	0.00	39.61	11.84	59.12
06/28/99	0.00	0.00	0.00	0.00	0.00	0.00	0.00	86.47
07/05/99	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
07/12/99	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
07/19/99	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
07/26/99	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Note: Pounds per day=(concentration)(flow)(.0053945)

Table 10 Pounds per Day of Acetochlor for the Wabash River and White River Sample Sites

Sample Week	WLV010-0002	WLV080-0005	WLV150-0001	WBU040-0003	WBU150 - 0002	WBU200 - 0003	WWL100-0005	WLW040-0001
04/05/99	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
04/26/99	10.84	13.49	14.30	30.641	0.00	52.82	66.08	122.30
05/03/99	4.09	5.36	0.00	0.00	0.00	13.89	16.18	25.62
05/10/99	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
05/17/99	27.73	0.00	0.00	31.83	86.10	88.04	18.36	81.56
05/24/99	55.67	24.92	22.40	31.02	31.83	41.07	66.03	172.50
05/31/99	85.45	50.22	39.23	0.00	31.36	112.53	0.00	45.10
06/07/99	9.84	19.71	28.59	47.20	82.32	119.73	29.99	403.00
06/14/99	19.79	0.00	0.00	0.00	23.30	0.00	0.00	63.12
06/21/99	0.00	8.93	10.70	13.08	0.00	22.00	0.00	29.56
06/28/99	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
07/05/99	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
07/12/99	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
07/19/99	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
07/26/99	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Note: Pounds per day=(concentration)(flow)(.0053945)

Table 11 Pounds per Day of Atrazine for the Kankakee River Basin Sample Sites

Sample Week	UMK040- 0003	UMK060-0001	UMK080-0001	UMK110-0002	UMK130-0001	UMI020-0002	UMI040-0001
04/05/99	0.00	0.00	0.00	0.00	0.00	0.00	0.00
04/26/99	0.00	0.00	0.00	0.00	0.40	0.254	2.98
05/03/99	0.00	0.00	0.00	0.00	0.10	0.09	0.73
05/10/99	0.00	0.00	0.00	0.00	0.27	0.08	0.00
05/17/99	0.00	0.00	0.00	0.00	0.00	0.07	0.64
05/24/99	1.50	8.00	52.18	0.00	0.21	0.00	0.00
05/31/99	0.00	10.40	0.00	0.00	3.16	0.00	4.63
06/07/99	0.00	0.00	0.00	0.00	0.00	0.00	0.00
06/14/99	0.00	7.20	5.27	5.85	2.78	0.00	2.43
06/21/99	0.00	0.00	0.00	0.00	0.00	0.00	0.00
06/28/99	0.00	1.40	0.00	0.00	0.20	0.00	0.71
07/05/99	0.00	0.00	0.00	0.00	0.00	0.00	0.00
07/12/99	0.00	0.00	0.00	0.00	0.00	0.00	0.00
07/19/99	0.00	0.00	0.00	0.00	0.00	0.00	0.37
07/26/99	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Note: Pounds per day=(concentration)(flow)(.0053945)

Table 12 Pounds per Day of Metolachlor for the Kankakee River Basin Sample Sites

Sample Week	UMK040- 0003	UMK060-0001	UMK080-0001	UMK110-0002	UMK130-0001	UMI020-0002	UMI040-0001
04/05/99	0.00	0.00	0.00	0.00	0.00	0.00	0.00
04/26/99	0.00	0.00	0.00	2.64	0.40	0.25	1.19
05/03/99	0.00	0.00	0.00	0.00	0.00	0.06	0.00
05/10/99	0.00	0.00	0.00	0.00	0.00	0.00	0.00
05/17/99	0.00	0.00	0.00	0.00	0.00	0.00	0.00
05/24/99	0.00	0.00	0.00	0.00	0.00	0.00	0.00
05/31/99	0.00	0.00	0.00	0.00	0.72	0.00	1.99
06/07/99	0.00	0.00	0.00	0.00	0.00	0.00	0.00
06/14/99	0.00	0.00	0.00	0.00	0.42	0.00	0.00
06/21/99	0.00	0.00	0.00	0.00	0.00	0.00	0.00
06/28/99	0.00	0.00	0.00	0.00	0.00	0.00	0.00
07/05/99	0.00	0.00	0.00	0.00	0.00	0.00	0.00
07/12/99	0.00	0.00	0.00	0.00	0.00	0.00	0.00
07/19/99	0.00	0.00	0.00	0.00	0.00	0.00	0.00
07/26/99	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Note: Pounds per day=(concentration)(flow)(.0053945)

Table 13 Pounds per Day of Acetochlor for the Kankakee River Basin Sample Sites

Sample Week	UMK040- 0003	UMK060-0001	UMK080-0001	UMK110-0002	UMK130-0001	UMI020-0002	UMI040-0001
04/05/99	0.00	0.00	0.00	0.00	0.00	0.00	0.00
04/26/99	0.00	0.00	0.00	0.00	0.00	0.00	1.19
05/03/99	0.00	0.00	0.00	0.00	0.20	0.06	0.47
05/10/99	0.00	0.00	0.00	0.00	0.34	0.00	0.00
05/17/99	0.00	0.00	0.00	0.00	0.00	0.00	0.00
05/24/99	0.00	2.40	20.20	0.00	0.00	0.00	0.00
05/31/99	0.00	3.00	0.00	0.00	0.79	0.00	1.10
06/07/99	0.00	0.00	0.00	0.00	0.00	0.00	0.00
06/14/99	0.00	1.50	0.00	0.00	0.51	0.00	0.00
06/21/99	0.00	0.00	0.00	0.00	0.00	0.00	0.00
06/28/99	0.00	0.00	0.00	0.00	0.00	0.00	0.00
07/05/99	0.00	0.00	0.00	0.00	0.00	0.00	0.00
07/12/99	0.00	0.00	0.00	0.00	0.00	0.00	0.00
07/19/99	0.00	0.00	0.00	0.00	0.00	0.00	0.00
07/26/99	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Note: Pounds per day=(concentration)(flow)(.0053945)

ESTIMATED HERBICIDE USAGE ON CORN CROP

Agricultural information used to create Tables 14 and 15 was derived from landuse information gathered while developing maps of the individual watersheds.

Table 14 shows the estimated usage of the three major herbicides on corn crops in the Lower Wabash River AND Kankakee River Basins, based on the1999 agricultural chemical usage (NASS 2000). The amount of pesticide applied was calculated using the approximate crop acreage in use during the study, the percent of individual herbicide applied and the rate applied per crop year. For example, the watershed upstream of the gaging station located on the Patoka River near Princeton (WPA080-0002) has an estimated 138,252 corn acres planted in its watershed. That acreage is multiplied by 91%, or the percentage of corn acres applied with atrazine as reported by NASS (2000). The result is then multiplied by 1.25 pounds per acre applied and that equals the estimated 157,262 pounds of atrazine in the watershed upstream of Station WPA080-0002. The rest of the chemicals were applied at different rates and percentages. Atrazine was the most prolific chemical used by Indiana corn producers while metolachlor was second and acetochlor was third. Metolachlor was also used on soybean crops so a combined total applied between the two crops has been determined and reported in Table 15.

Table 14 Estimated Herbicide Usage on Corn Crops per Crop Year

Site	Drainage Area in Basin sq./mi.[1]	Acres Planted to Corn[2]	Pounds of Atrazine applied[3]	Pounds of Acetochlor applied[4]	Pounds of Metolachlor applied[5]	Pounds of Metolachlor applied to bean and corn crops[6]
UMK040-0003	537	145,067	165,014	73,752	96,136	104,622
UMK060-0001	435	118,137	134,381	60,061	78,289	82,896
UMK080-0001	1,352	313,993	357,167	159,634	208,083	220,329
UMK110-0002	1,779	504,889	574,311	256,686	334,590	354,281
UMK130-0001	123	33,344	37,929	16,952	22,097	23,397
UMI020-0002	36	33,798	38,445	17,183	22,398	23,716
UMI040-0001	449	133,307	151,637	67,773	88,343	93,542
WLV010-0002	7,267	2,135,135	2,444,866	937,907	1,421,775	1,452,533
WLV080-0005	8,218	2,410,887	2,418,869	1,224,858	1,604,516	1,637,425
WSU050-0006	509	153,442	174,540	78,010	101,686	107,670
WSU020-0004	33	9,120	10,374	4,637	6,044	6,400
WLV150-0001	11,118	3,081,380	3,477,182	1,555,490	1,970,913	2,095,612
WLV160-0002	139	43,343	49,303	22,036	28,723	30,413
WLV170-0003	222	61,842	70,345	31,440	40,983	43,395
WLV190-0003	448	113,604	129,225	57,756	74,751	81,397
WBU040-0003	12,263	3,709,675	4,183,626	1,872,198	2,372,344	2,410,005
WBU150-0002	13,161	3,824,193	4,313,165	1,930,075	2,445,770	2,484,182
WBU160-0002	228	48,400	55,055	24,607	31,847	34,678
WBU200-0003	13,706	3,872,875	5,183,756	1,956,037	2,486,720	2,526,014
WWL100-0005	11,125	2,488,159	2,830,281	1,264,980	1,637,209	1,782,766
WPA080-0002	822	138,252	157,262	70,287	90,970	93,801
WLW040-0001	28,635	7,361,784	8,301,210	3,715,323	4,695,096	4,755,597

[1] values reported from Tables 1 & 2
[2] estimated crop acreage for the watershed of each sampling site derived from NASS (2000) and Geographical Information System
[3] Atrazine application rates for each state included in the Wabash River Basin
91% of Indiana's corn acreage receives atrazine at a rate of 1.25 pounds per acre
84% of Illinois' corn acreage receives atrazine at a rate of 1.25 pounds per acre
83% of Ohio's corn acreage receives atrazine at a rate of 1.33 pounds per acre
[4] Acetochlor application rate for each state included in the Wabash River Basin
31% of Indiana's corn acreage receives acetochlor at a rate of 1.64 pounds per acre
24% of Illinois' corn acreage receives acetochlor at a rate of 2.04 pounds per acre
25% of Ohio's corn acreage receives acetochlor at a rate of 1.99 pounds per acre
[5] Metolachlor application rate for each state included in the Wabash River Basin
47% of Indiana's corn acreage receives metolachlor at a rate of 1.40 pounds per acre
33% of Illinois' corn acreage receives metolachlor at a rate of 1.60 pounds per acre
45% of Ohio's corn acreage receives metolachlor at a rate of 1.67 pounds per acre
[6] total metolachlor applied by combining corn and bean application amounts from Tables 9 and 10

ESTIMATED HERBICIDE USAGE ON SOYBEAN CROPS

Table 15 contains different chemicals than Table 14 because soybeans require different pesticides than corn. Glyphosate was the most desirable of the four preferred herbicides. Pendimethalin was the second most commonly used herbicide, followed by metolachlor and 2,4-

D.

Table 15 Estimated Herbicide Usage on Soybean Crops per Crop Year

Site	Drainage Area in Basin sq. mi.[1]	Acres Planted to Soybeans[2]	Pounds of Glyphosate applied[3]	Pounds of Pendimethalin applied[4]	Pounds of Metolachlor applied[5]	Pounds of 2,4-D applied[6]
UMK040-0003	537	145,067	80,483	9,400	8,486	4,526
UMK060-0001	435	118,137	65,542	7,655	6,911	3,686
UMK080-0001	1,352	313,993	174,203	20,347	18,369	9,797
UMK110-0002	1,779	504,889	280,112	32,717	29,536	15,753
UMK130-0001	123	33,344	18,499	2,161	1,951	1,040
UMI020-0002	36	33,798	18,751	2,190	1,977	1,055
UMI040-0001	449	133,307	73,959	8,638	7,798	4,159
WLV010-0002	7,267	2,135,134	1,687,610	138,357	83,270	66,616
WLV080-0005	8,218	2,410,886	1,905,564	156,225	94,025	75,220
WSU050-0006	509	153,442	85,130	9,943	8,976	4,787
WSU020-0004	33	9,120	5,060	591	534	285
WLV150-0001	11,118	3,081,380	2,435,523	199,673	120,174	96,139
WLV160-0002	139	43,343	24,047	2,809	2,536	1,352
WLV170-0003	222	61,842	34,310	4,007	3,618	1,929
WLV190-0003	448	113,604	63,027	7,362	6,646	3,544
WBU040-0003	12,263	3,709,674	2,932,126	240,387	144,677	115,742
WBU150-0002	13,161	3,824,193	3,022,642	247,808	149,144	119315
WBU160-0002	228	48,400	26,852	3,136	2,831	1,510
WBU200-0003	13,706	3,872,874	2,148,670	250,962	226,563	120,834
WWL100-0005	11,125	2,488,159	1,380,430	161,233	145,557	77,631
WPA080-0002	822	138,252	76,702	8,959	8,088	4,313
WLW040-0001	28,635	14,569,928	8,083,396	944,131	852,341	454,582

[1] values reported from Tables 1 & 2.
[2] estimated soybean acreage for the watershed of the sampling site derived from NASS (2000) and Geographical Information System
[3] Glyphosate application rates for each state included in the Wabash River Basin
76% of Indiana's soybean acreage received glyphosate at a rate of 0.73 pounds per acre
58% of Illinois' soybean acreage received glyphosate at a rate of 0.88 pounds per acre
64% of Ohio's soybean acreage received glyphosate at a rate of 0.79 pounds per acre
[4] Pendimethalin application rates for each state included in the Wabash River Basin
8% of Indiana's soybean acreage received pendimethalin at a rate of 0.81 pounds per acre
17% of Illinois' soybean acreage received pendimethalin at a rate of 1.07 pounds per acre
6% of Ohio's soybean acreage received pendimethalin at a rate of 0.72 pounds per acre
[5] Metolachlor application rates for each state included in the Wabash River Basin
3% of Indiana's soybean acreage received metolachlor at a rate of 0.26 pounds per acre
No reported use of metolachlor on soybean crops in Illinois
11% of Ohio's soybean acreage received metolachlor at a rate of 1.74 pounds per acre
[6] 2,4-D application rates for each state included in the Wabash River Basin
8% of Indiana's soybean acreage received 2,4-D at a rate of 0.39 pounds per acre
10% of Illinois' soybean acreage received 2,4-D at a rate of 0.46 pounds per acre
9% of Ohio's soybean acreage received 2,4-D at a rate of 0.58 pounds per acre

RUNOFF CALCULATIONS

The importance of noting the percent runoff is to become aware of the watersheds that seem to be at a higher risk of pesticides entering into surface water. There are many factors that can cause a significant change in the amount of runoff within a watershed. Some of these are soil formation, agricultural practices, rainfall events and their frequency, and watershed land uses. One that can be noted in this study is rainfall that correlated with sampling time. As noted earlier, the study design called for sampling on a weekly basis with only one sample per site.

Table 16 Percentage of contributing tributaries to the Lower Wabash River Basin

Water Shed Name	Station Representing Watershed	% of contributing land area	% contribution to total lbs. of atrazine	% contribution to total lbs. of acetochlor	% contribution to total lbs. of metolachlor
Sugar Creek	**WSU050-0006**	2%	<0.5%	0.5%	2.5%
Big Raccoon Cr	**WLV190-0003**	2%	<0.5%	1.0%	1.5%
Busseron Creek	**WBU160-0002**	1%	1.5%	2.0%	0.5%
White River	**WWL100-0005**	39%	6.0%	26.5%	16.0%
Patoka River	**WPA080-0002**	3%	1.5%	3.0%	6.5%
Summary Statistics for Lower Wabash River Basin					
	WLW040-0001	28,635 mi^2	253,957 total lbs. atrazine	7,389 total lbs. acetochlor	12,940 total lbs. metolachlor

Table 16 compares the percentage of land area that each of the tributaries contributes to the final sample site along the Wabash River (WLW040-0001) to the percent of contributed pounds of the three selected herbicides from those tributaries. It is clear that as the size of the watershed increases so does its contributing load. However it is not a well defined correlation, variations can be attributed to the soil formation, agricultural practices, rainfall events and their frequency, and the surrounding land use. The poor correlation can also be a factor of sampling frequency. The smaller watersheds will have a more volatile reaction to a rainfall event, and the larger watersheds will react slower and have a longer concentration peak. This type of reaction to rainfall events prevents a very accurate representation of the smaller streams.

The regions of Indiana that contain the Lower Wabash River Basin experienced rainfall totals that were a little below normal for the months of April through July. The Kankakee River Basin received nearly 1.5 times the normal amount for April through July (Scheeringa 2000). This data is presented in Table 17. The weekly rainfall totals within the Lower Wabash Basin were fairly consistent throughout the entire sampling season. The major rainfall events within this basin occured between May 30 through July 10. During this six-week period there were two distinct peaks of rainfall. From April 4 through May 29, the weekly rainfall totals ranged between 1.5 inches to 0.25 inches with only small deviations between each week. The week ending on May 29 only received 0.25 inches of rain then the week starting May 30 received 1.98 inches of rain. This is the first major spike of the rainfall totals. The next three weeks all fall below the one-inch mark then on the week beginning on June 27 the weekly total increases to 2.75 inches. This

is the second major spike of rainfall during the sampling season in the Lower Wabash Basin. The remaining weeks displayed no distinct peaks.
The Kankakee River Basin displayed four peaks between April 4 through July 31. The first peak occurred during the week beginning April 11 where the total jumped from 0.84 inches the week before to 2.24 inches. The next five weeks show a gradual decline in the weekly totals with the week ending on May 29 received 0.28 inches of rain then on the week beginning on May 30 the total jumped up to 2.12 inches. The following week the total dropped to 1.06 inches then the week starting on June 13 the weekly total increased to 5.71 inches. This three-week period easily contains the most significant rainfall totals and the most distinct peak for the Kankakee River Basin. After that peak the totals begin to slack off and only a few more minor peaks occur (Scheeringa 2000).

Table 17 Rainfall Data for Each Watershed Basin During the Months of April-July

Basin	April (Measured/Normal)	May (Measured/Normal)	June (Measured/Normal)	July (Measured/Normal)
Kankakee	6.09"/3.78"	3.00"/3.72"	10.51"/4.00"	2.87"/3.88"
Lower Wabash	4.28"/4.02"	2.89"/4.61"	4.77"/3.87"	3.69"/4.51"

TREND ANALYSIS

By evaluating the pesticides data in Figures 7-13 (Kankakee River Basin), and Figures 14 - 28 (Lower Wabash River Basin), recognizable trends begin to develop. The combination of weather patterns, farming practices, watershed characteristics, and the chemical properties of the herbicides determine their fate during late spring and early summer. It is clearly apparent that pesticide loading in the surface waters is dependent on wet weather events coupled with seasonal patterns associated with farming practices.

The bulk of the pesticides detected in this investigation are agricultural herbicides. These herbicides are primarily applied from preplant through the early part of the postemergent phase of a cropped field. The application of agricultural pesticides usually precedes or coincides with the heaviest seasonal rainfall totals for Indiana. The herbicides found in the surface water using EPA Test Method 525.2 are primarily water-soluble. This physical property allows the pesticides to be more mobile increasing the amount of herbicides in precipitation run off. The less water soluble a pesticide is the more affinity the chemical has to organic mater or soil particles, and the less likely the pesticide will run off into the surface waters.

By observing herbicide concentrations plotted against time, a trend of two distinct peaks is noticed on a majority of the graphs. The first peak can be attributed to the application of the chemicals. Typically this peak is observed to begin in late April and attains its highest point near mid-May. A peak during this time frame can be due to exceptionally high amounts of chemicals available for runoff combined with small rainfall events, and atmospheric deposition resulting from drift after chemical application. This peak is normally followed by a one to three week plateau or decline in the concentration values, then a dramatic increase of the concentration. It should be noted the bulk of the application has ended by this time so there is not as much deposition from the atmosphere. The increase in concentration can be related to the increase of rainfall events. The trend after this high point was downward in concentration values. This occurs because the effort of applying pesticides is reduced after the plants have grown to a certain size, and any additional applications occurring during this stage are applied to plants that have all ready sprouted. Applying herbicides to land with growing plants decreases runoff of chemicals.

Other factors affecting the presence of a chemical in the surface water is the use within the watershed and the half-life of the chemical. Clearly a chemical with limited use will have limited presence within the watershed. A chemical with a longer half-life will be more persistent in the water. An example can be seen comparing atrazine and acetochlor. Atrazine has a half-life of about 60 days and acetochlor has a half-life of only about 10 days. Atrazine was also used on a higher percentage of corn than acetochlor. These factors will impact the presence of chemicals in surface water.

The sampling sites in the Lower Wabash River Basin displayed this type of trend when the concentration is graphed according to the date. The results were similar to previous studies (Grady 1998, McDuffee 2001). The graphs of the Kankakee Basin displayed a similar trend. The concentration peaks occur during the same time frame, but the concentrations and the duration of the event is significantly smaller.

As an example, atrazine is the most detected herbicide in this and past pesticide surveys (Grady 1998, McDuffee 2001). The 15 sites located in the Lower Wabash Basin had atrazine detected in the samples an average of 13 times during the 15-week survey. The sampling sites within the Kankakee River Basin had atrazine detected only an average of 4 times per site during the 15-week survey. The Kankakee River had three sites located on its main-stem. Even when combined, these three sites only detected atrazine four times for the entire sampling season. The other four sample sites located along tributaries of the Kankakee River detected atrazine four times the amount of the main-stem sites. Row crops are estimated at 89% of the land area in that basin, and corn and soybeans are the dominant row crop.

A possible reason for this lack of herbicides detected in the samples may be due to the soil formations and related topography. The Kankakee River Basin has the characteristics of the Grand Kankakee Marsh, which was drained to less than 6 percent of its original size by the early 1900's. The drained area has a very low relief and has high concentrations of sand incorporated in the soil. Both of these traits help to reduce surface runoff by increasing soil infiltration. The further away from the main-stem of the Kankakee River the more other influences determined the soil composition as well as the topography of the area. That could explain the difference in the runoff within the Kankakee River Basin.

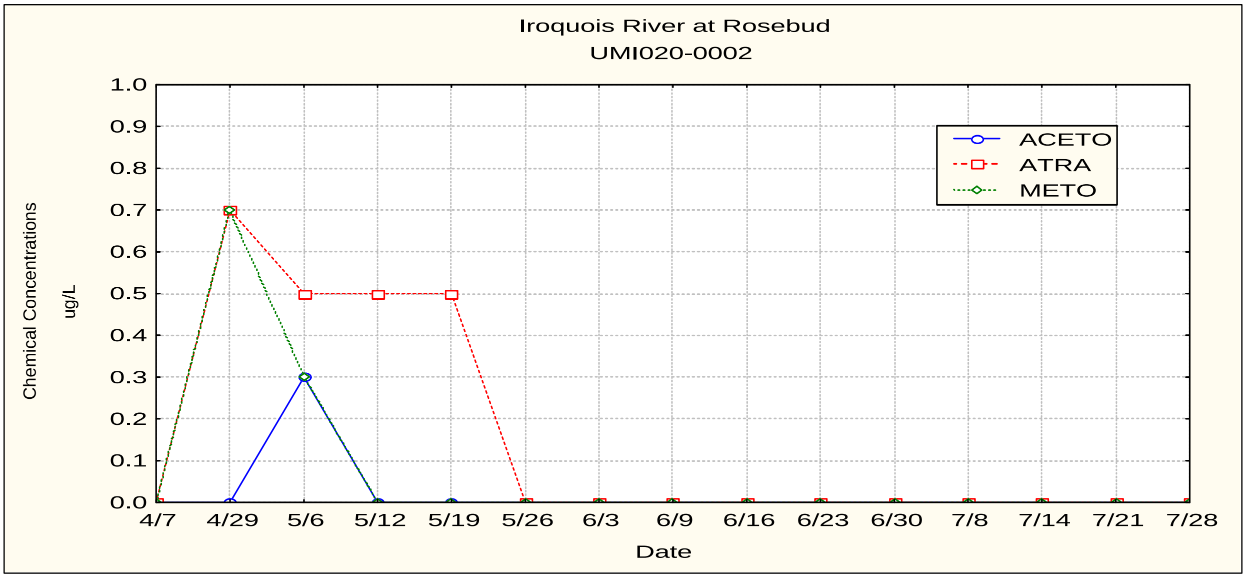

Figure 7 Concentration Over Time of Selected Pesticides at Site UMI020-0002 (Iroquois River at Rosebud)

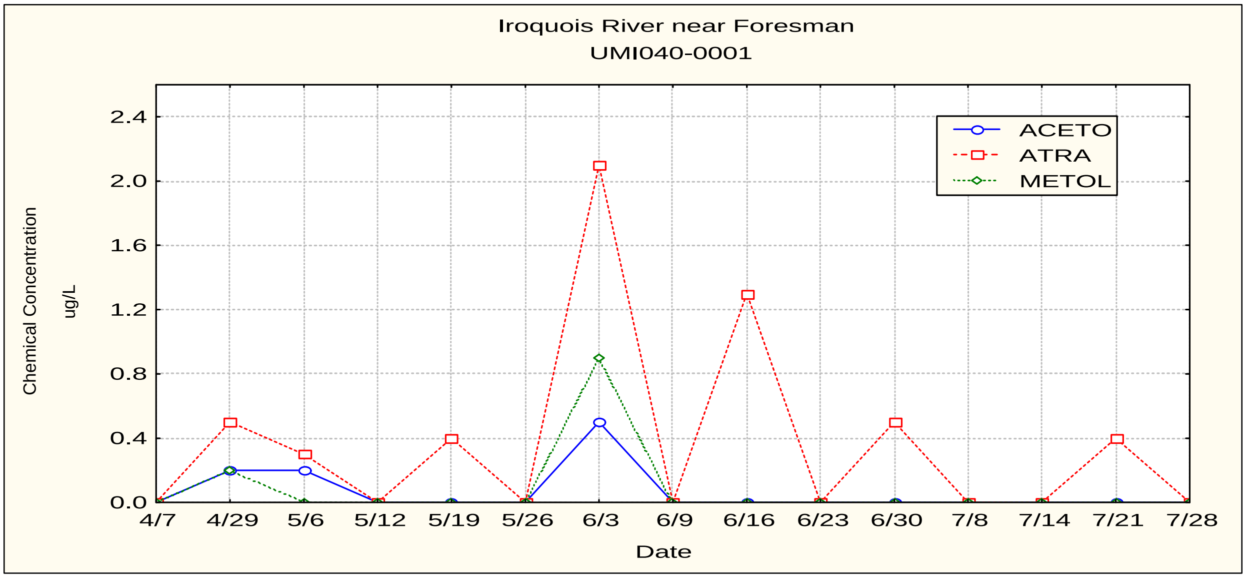

Figure 8 Concentration Over Time of Selected Pesticides at Site UMI040-0001 (Iroquois River at Foresman)

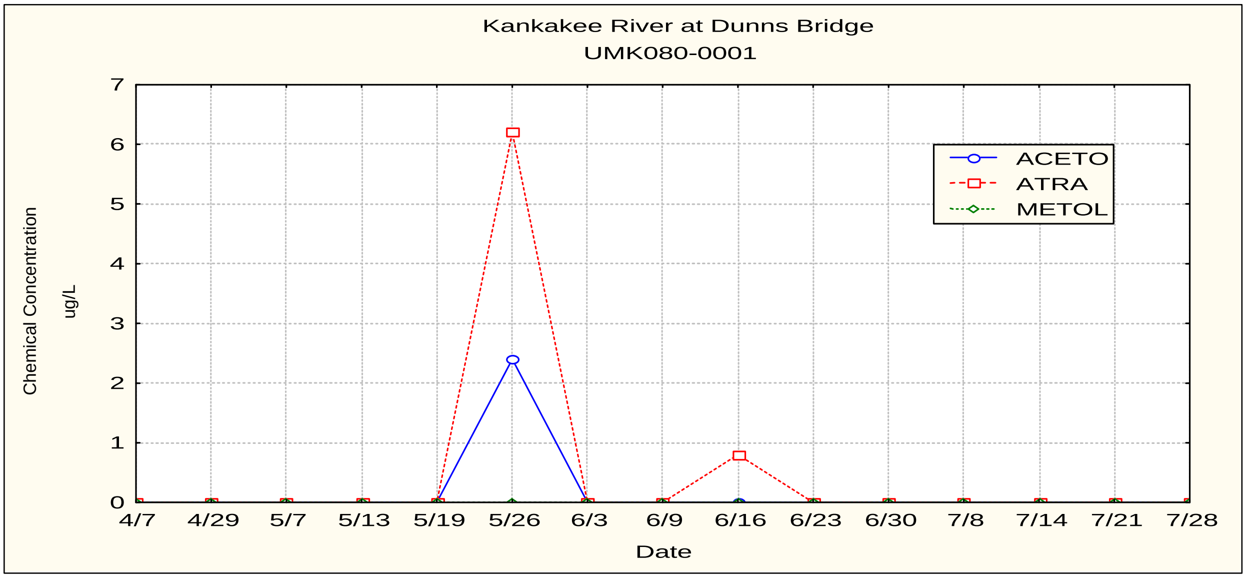

Figure 9 Concentration Over Time of Selected Pesticides at Site UMK080-0001 (Kankakee River at Dunn's Bridge)

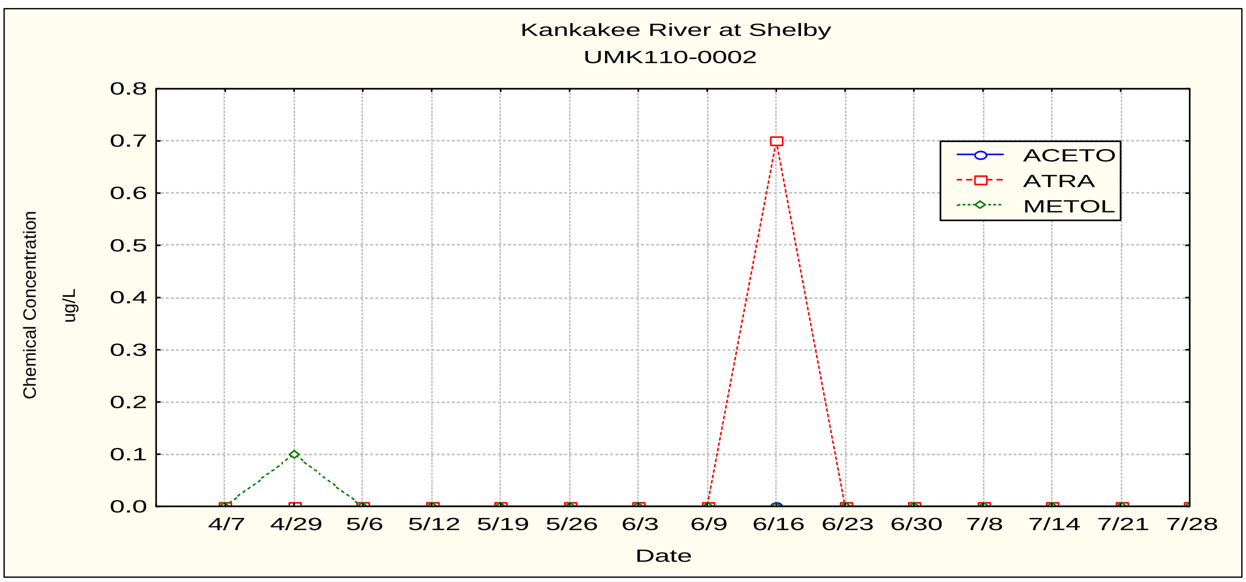

Figure 10 Concentration Over Time of Selected Pesticides at Site UMK110-0002 (Kankakee River at Shelby)

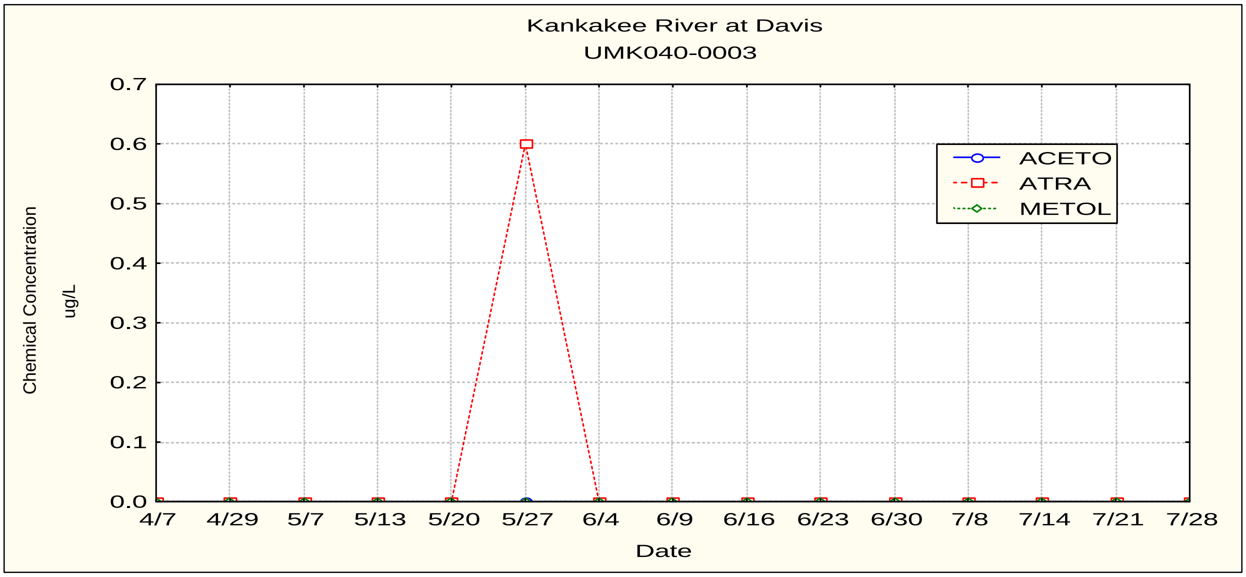

Figure 11 Concentration Over Time of Selected Pesticides at Site UMK040-0003 (Kankakee River at Davis)

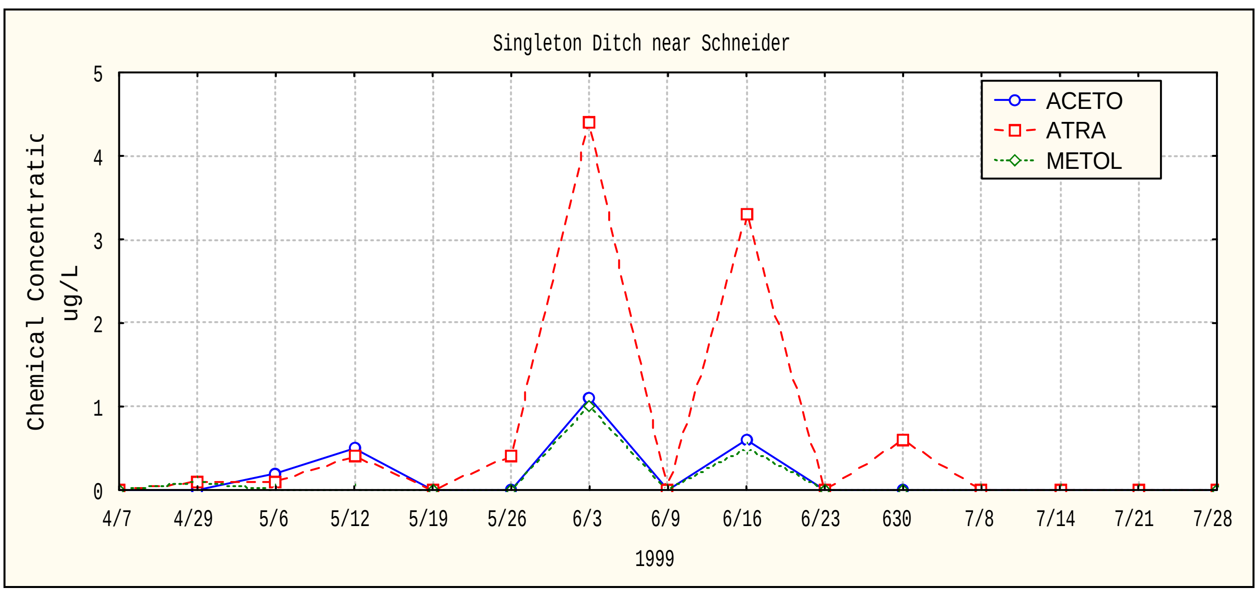

Figure 12 Concentration Over Time of Selected Pesticides at Site UMK130-0001 (Singleton Ditch near Schneider)

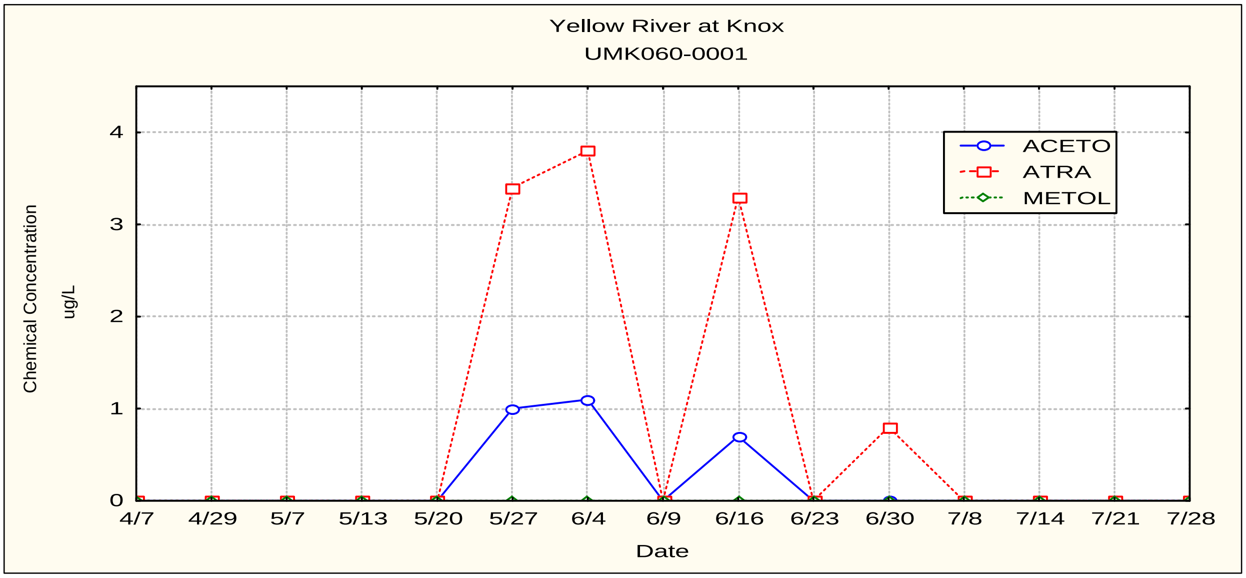

Figure 13 Concentration Over Time of Selected Pesticides at Site UMK060-0001 (Yellow River at Knox)

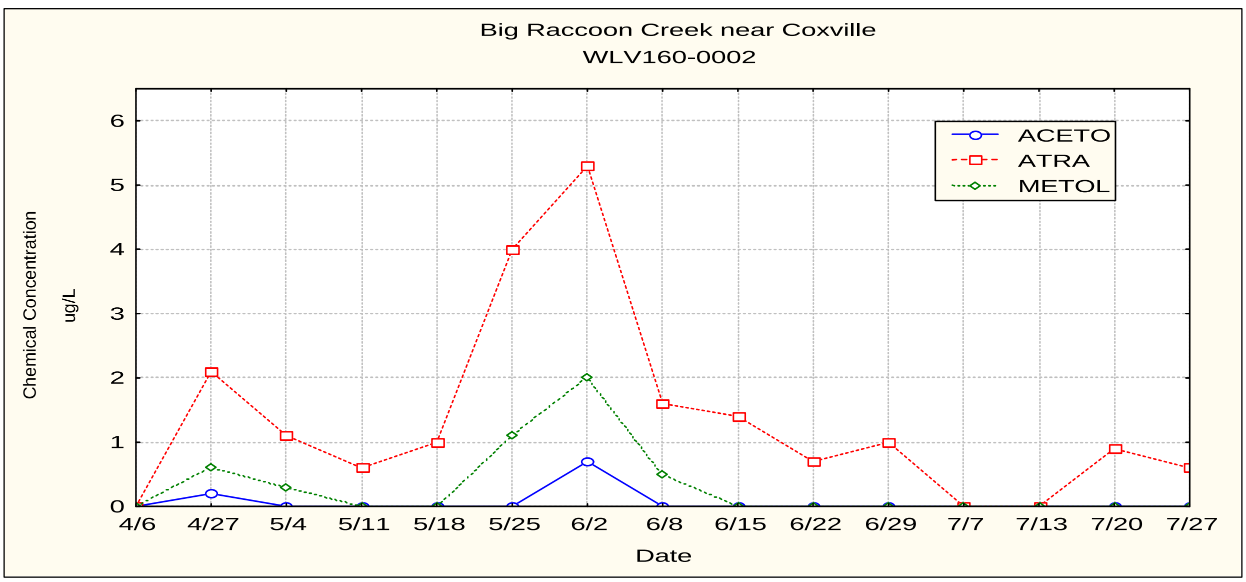

Figure 14 Concentration Over Time of Selected Pesticides at Site WLV160-0002 (Big Raccoon Creek near Coxville)

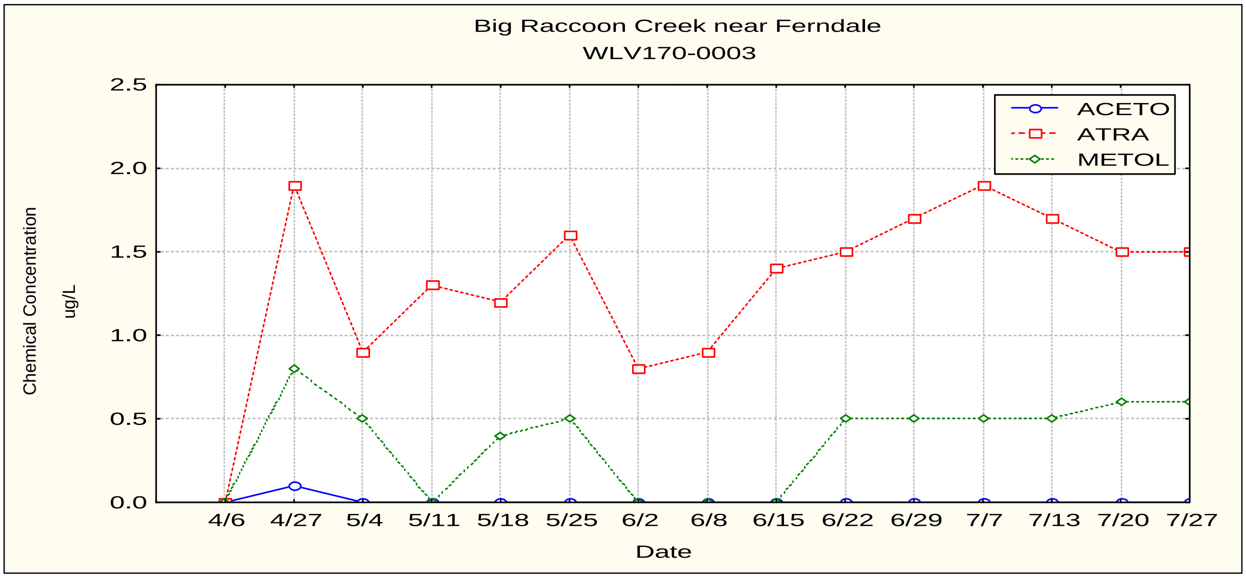

Figure 15 Concentration Over Time of Selected Pesticides at Site WLV170-0003 (Big Raccoon Creek near Ferndale)

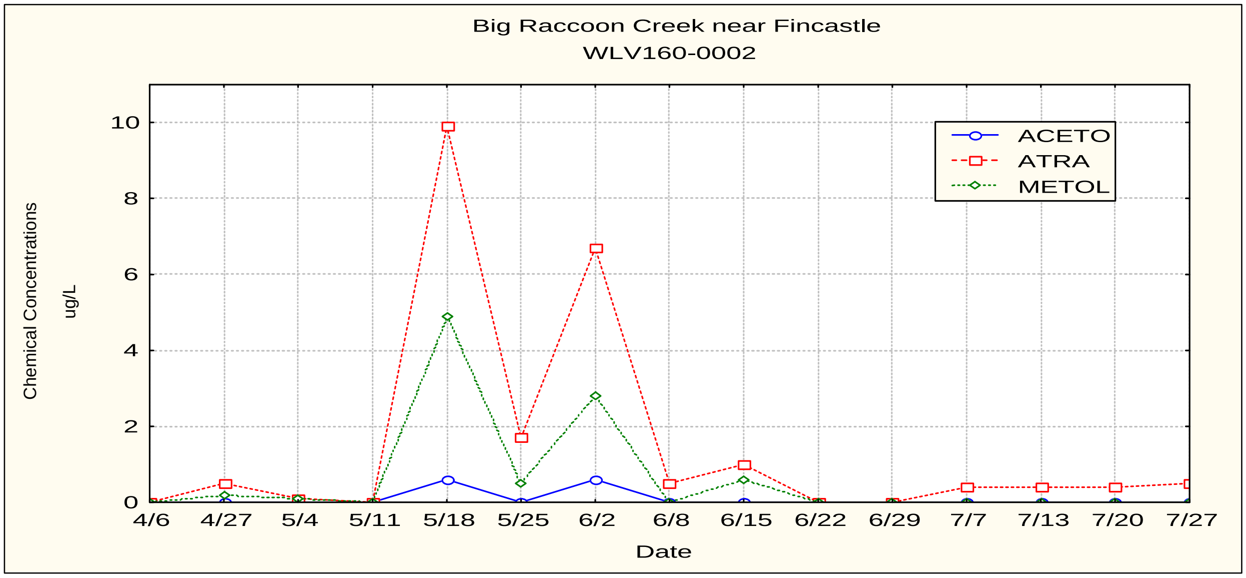

Figure 16 Concentration Over Time of Selected Pesticides at Site WLV160-0002 (Big Raccoon Creek near Fincastle)

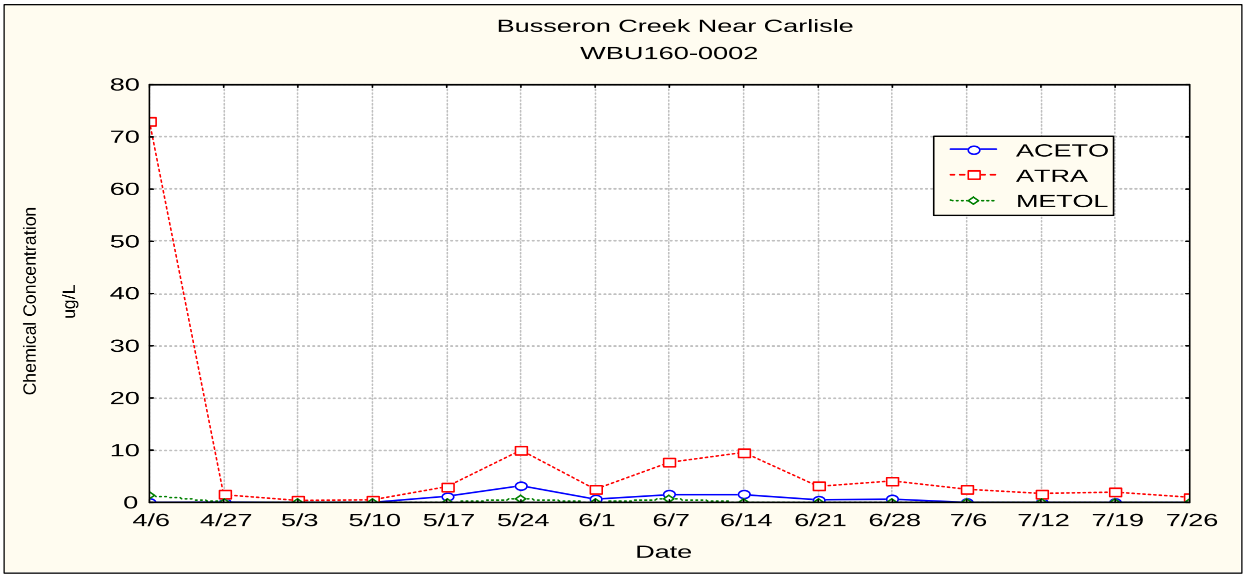

Figure 17 Concentration Over Time of Selected Pesticides at Site WBU160-0002 (Busseron Creek near Carlisle)

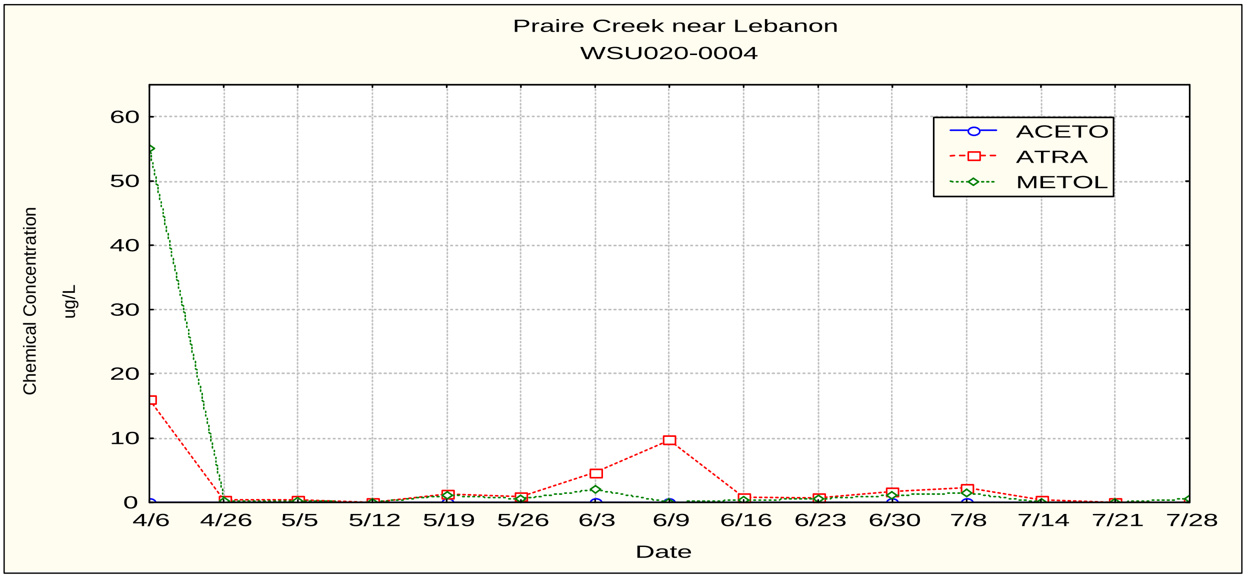

Figure 18 Concentration Over Time of Selected Pesticides at Site WSU020-0004 (Prairie Creek near Lebanon)

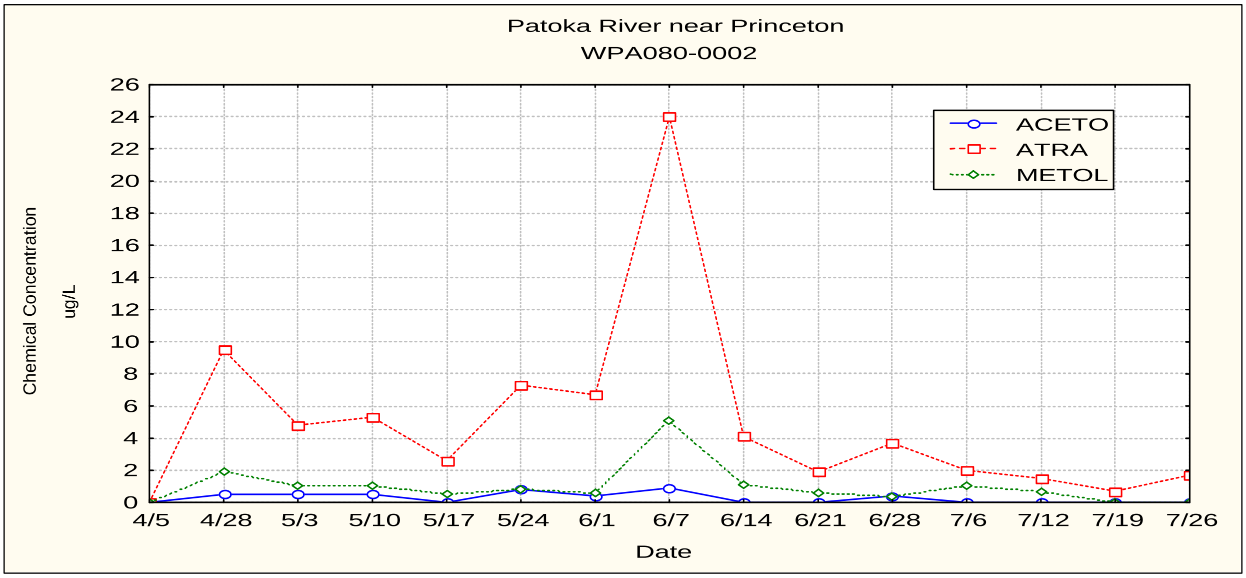

Figure 19 Concentration Over Time of Selected Pesticides at Site WPA080-0002 (Patoka River near Princeton)

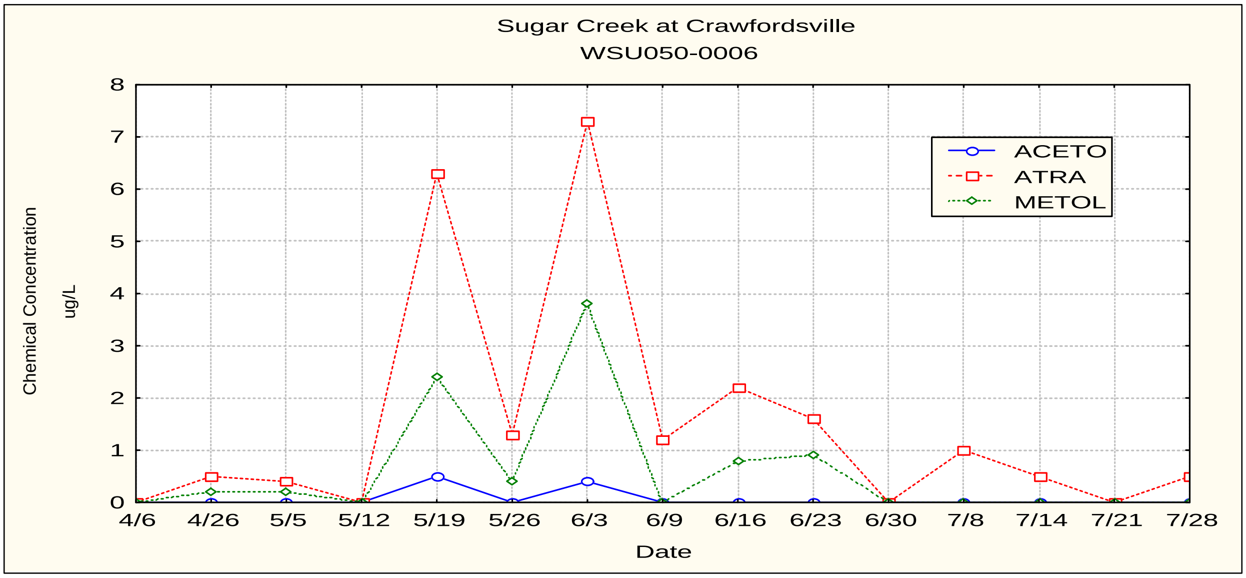

Figure 20 Concentration Over Time of Selected Pesticides at Site WSU050-0006 (Sugar Creek at Crawfordsville)

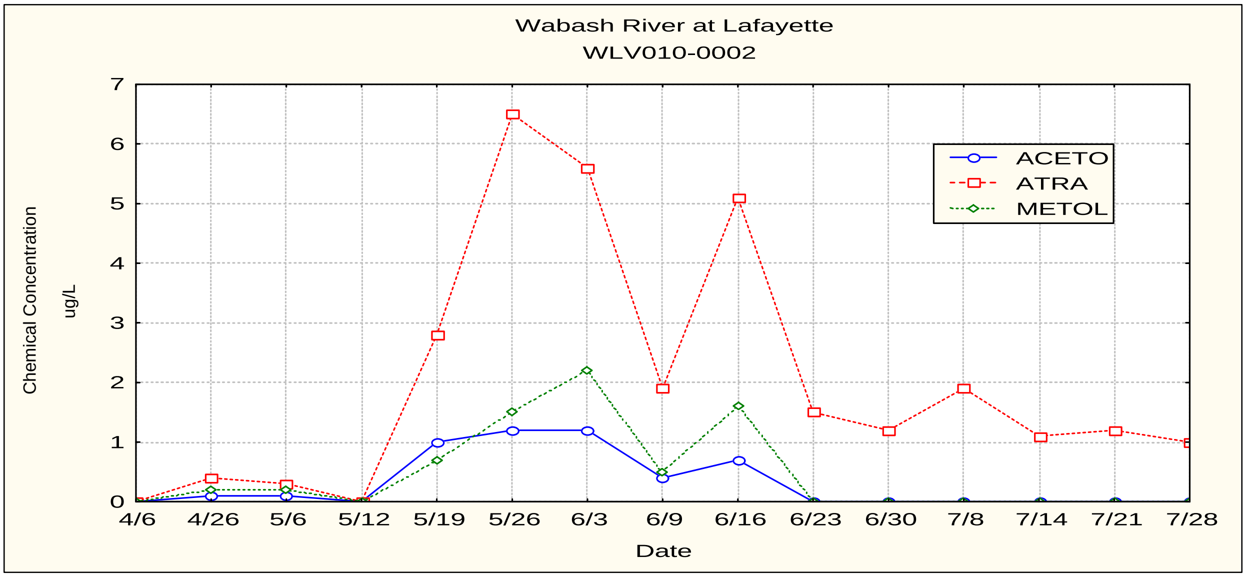

Figure 21 Concentration Over Time of Selected Pesticides at Site WLV010-0002 (Wabash River at Lafayette)

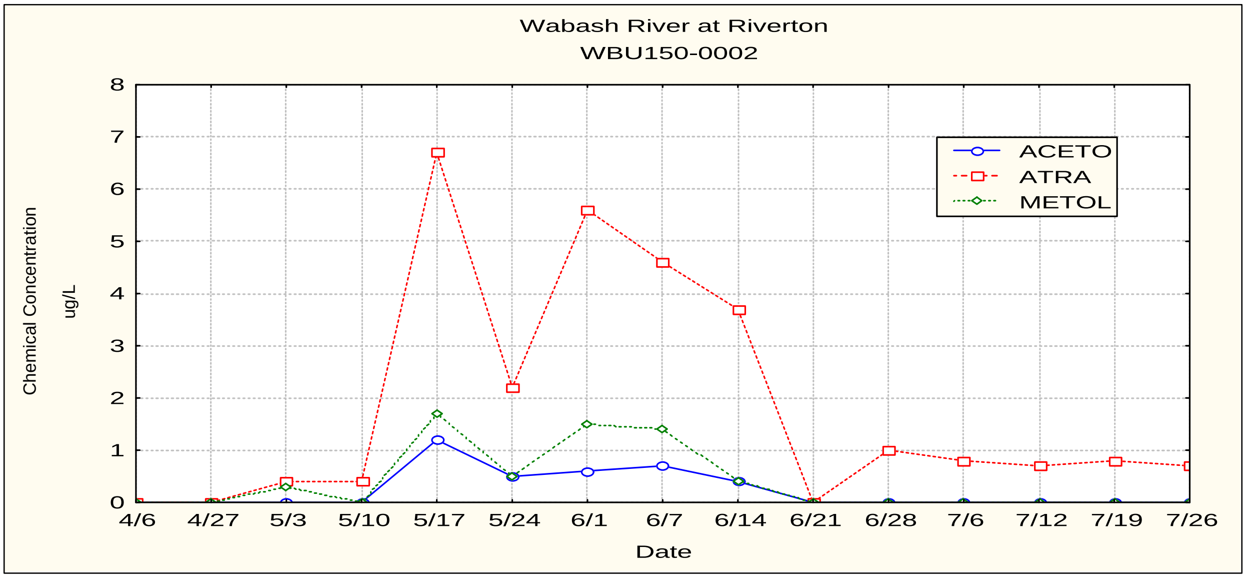

Figure 22 Concentration Over Time of Selected Pesticides at Site WBU150-0002 (Wabash River at Riverton)

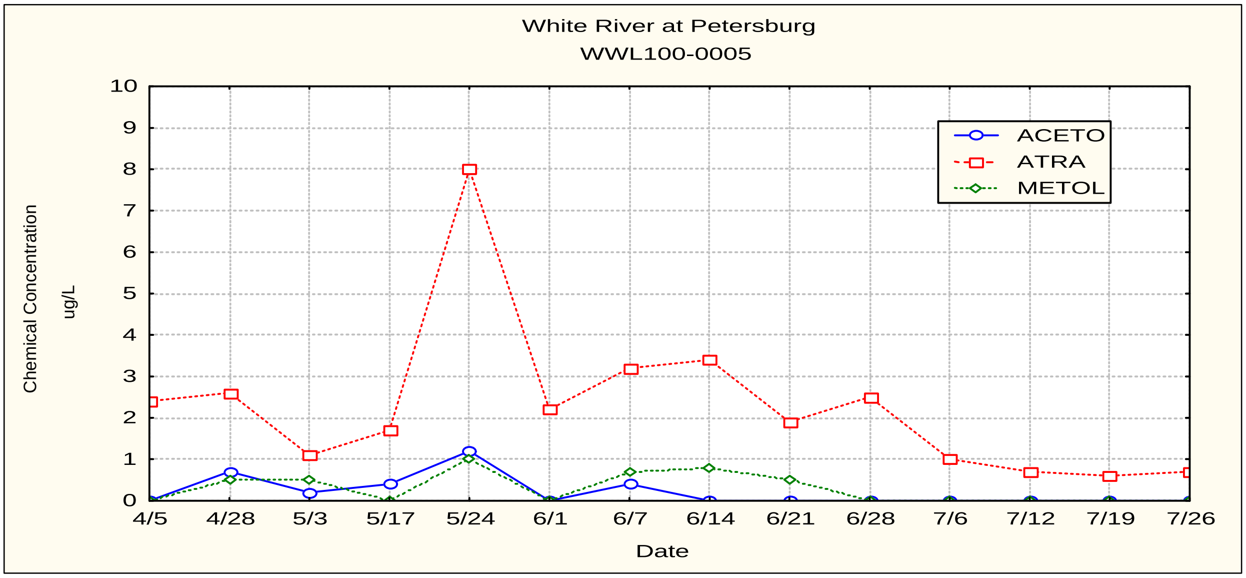

Figure 23 Concentration Over Time of Selected Pesticides at Site WWL100-0005 (Wabash River at Petersburg)

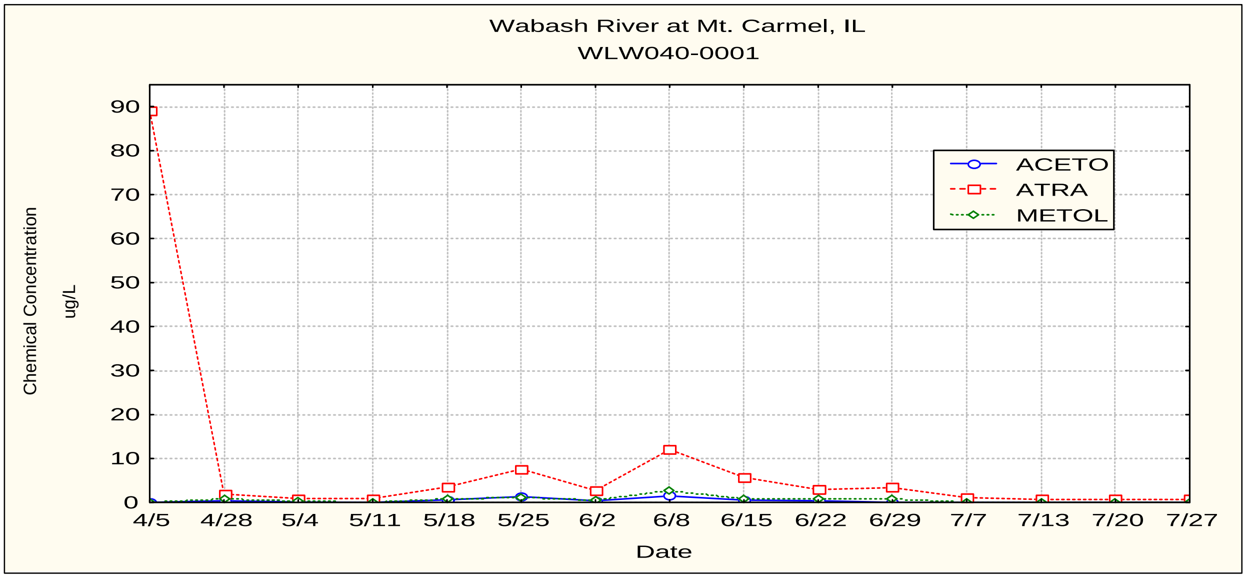

Figure 24 Concentration Over Time of Selected Pesticides at Site WLW040-0001 (Wabash River at Mt. Carmel, IL)

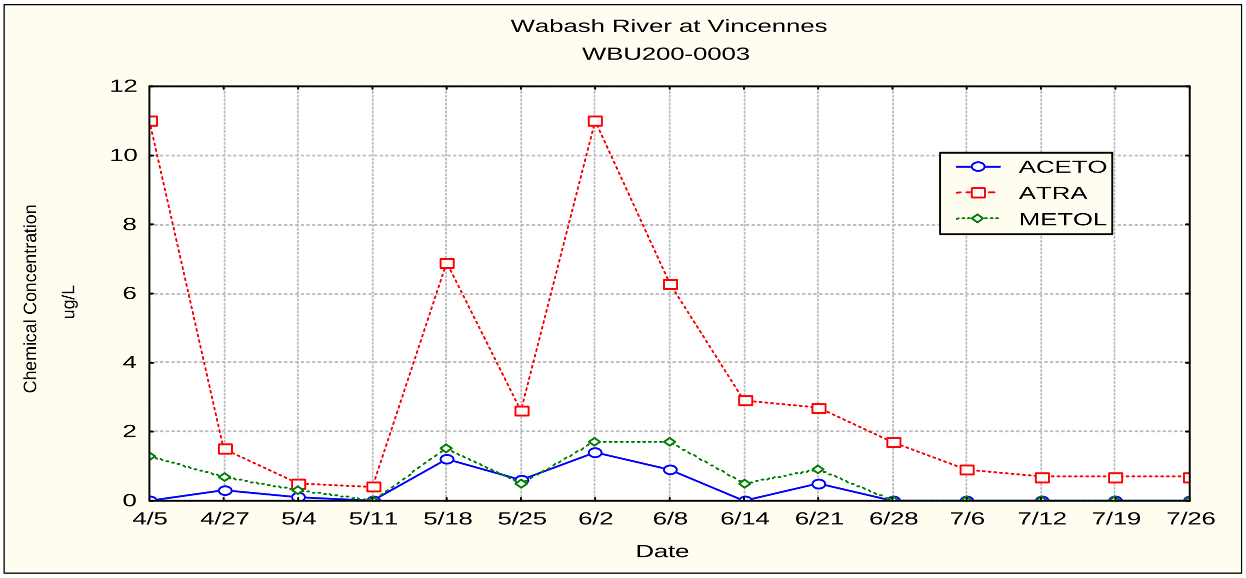

Figure 25 Concentration Over Time of Selected Pesticides at Site WBU200-0003 (Wabash River at Vincennes)

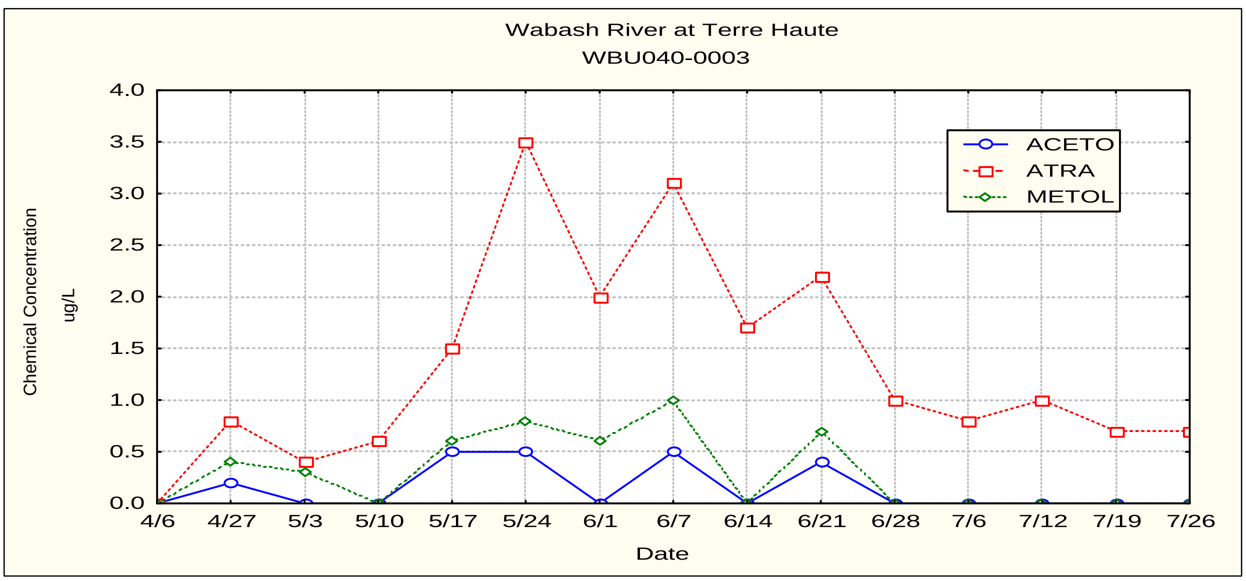

Figure 26 Concentration Over Time of Selected Pesticides at Site WBU040-0003 (Wabash River at Terre Haute)

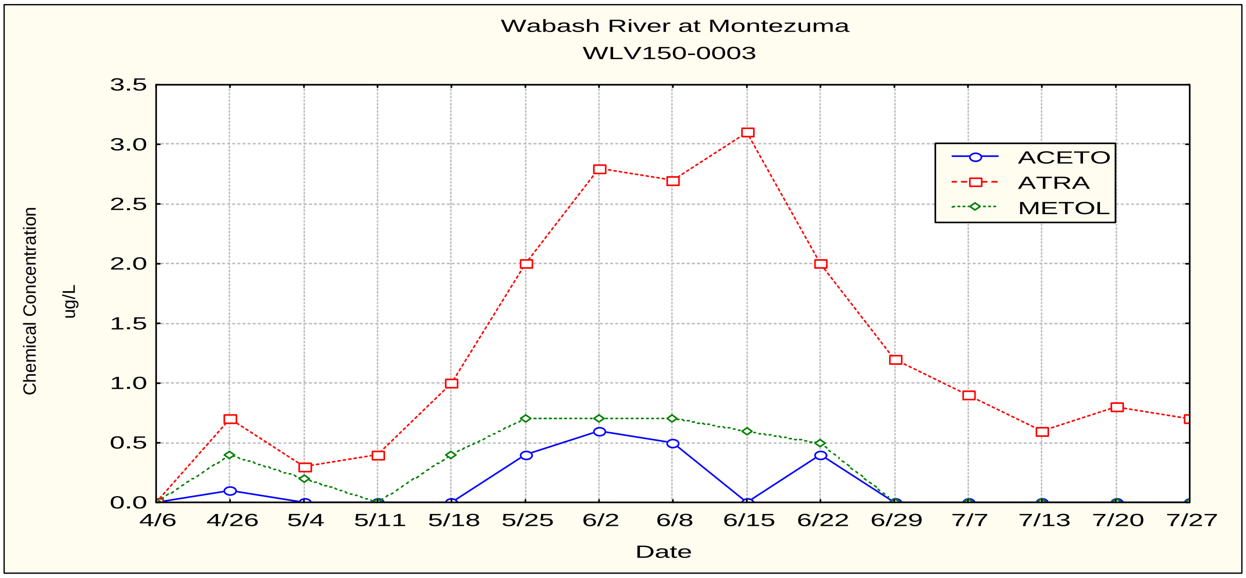

Figure 27 Concentration Over Time of Selected Pesticides at Site WLV150-0003 (Wabash River at Montezuma)

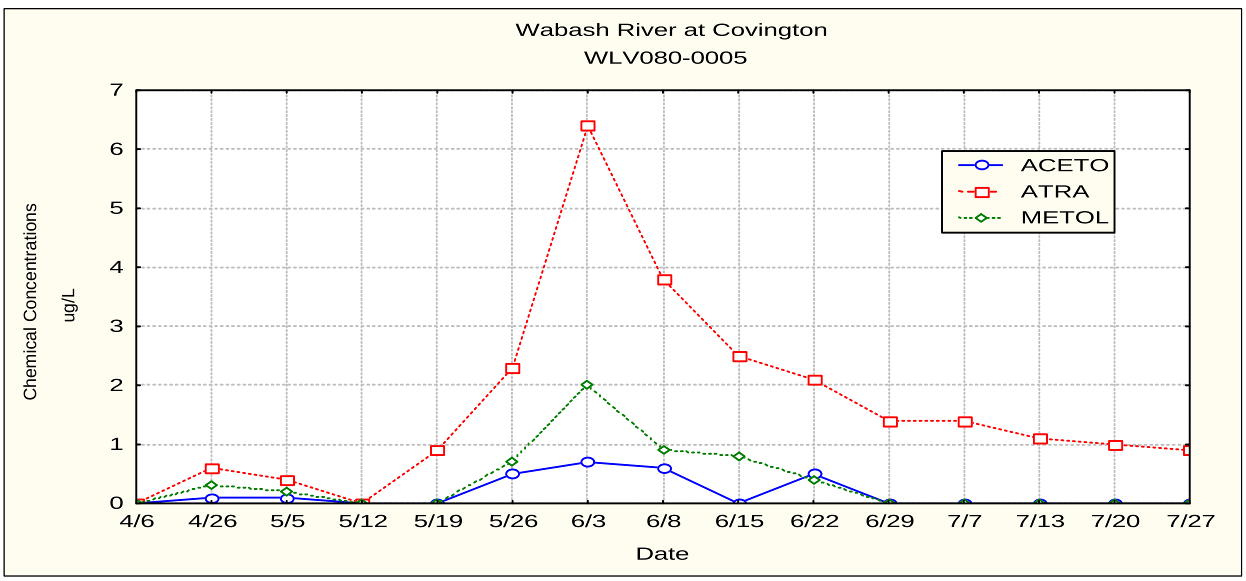

Figure 28 Concentration Over Time of Selected Pesticides at Site WLV080-0005 (Wabash River at Covington)

DRINKING WATER CONCERNS

There are no Public Water Supply Facilities that have their drinking water intake points in the Lower Wabash River Basin or the Kankakee River Basin. However there are 55 surface water intakes located in Indiana and 42 of those sites are located within the Wabash River Drainage. A report produced by Laws et al. (2000) cited a number of reports on the affect of atrazine on mammals. These studies do indicate a concern that atrazine is an endocrine disrupter and has a potential to produce tumors in a long term setting. IDEM=s Office of Drinking Water has recently implemented ASource Water Protection Program@ for human health and safety. It is proposed that to comply with the IDEM=s Source Water Protection Program, concerned Public Water Supplies in the Wabash River Basin take appropriate measures to reduce human exposure to these pesticides in drinking water.

RECOMMENDATIONS AND CONCLUSIONS

1. Future pesticides monitoring is vital in order to understand the affects of pesticides in surface water. Trends in pesticide use within these basins need to be monitored in order to identify emerging water quality issues. Attention to new pesticides coming into the market is also important.

2. This project has the potential to highlight areas that pose possible non-point pollution problems. This information can be used for Non-point Source Best Management Practices. Priority should be given to federally funded Clean Water Act Section 319 grant projects within these basins to help alleviate the runoff potential.

3. Studies of this nature have been scheduled for the entire state of Indiana so that pesticide occurrence, concentrations, and loading can be understood for major tributaries throughout the state. Future monitoring is essential to track the long-term trends associated with pesticides in the surface waters of Indiana.

4. Drinking Water Quality Standards were used for comparison purposes only because there are no Surface Water Quality Standards for the herbicides covered in this report.

LITERATURE CITED

Ahrens WH. 1994. Herbicide Handbook Committee. *Herbicide Handbook, Seventh Edition.* Weed Science Society of America.

Bowren T, GhiasUddin S. 1999. *Quality Assurance Project Plan(QAPP) for Indiana Surface Water Quality Monitoring Programs.* Revision 2, July 1999. Indiana Department of Environmental Management, Office of Water Management, Assessment Branch. Indianapolis, Indiana. Prepared for US Environmental Protection Agency(USEPA) Region V, Water Division. EPA Grant Nr M005180-99-0, C995008-99-0. IDEM 032/01/1442/1999. 103 p. 7 ap.

Carter DS, Lydy M.J., Crawford CG. 1995. *Water-Quality Assessment of the White River Basin, Indiana: Analysis of Available Information on Pesticides*, 1972-92. U.S. Geological Survey, Water-Resource Investigations Report 94-4034.

Crawford C. 1997. *Trends in Acetochlor Concentrations in Surface Waters of the White River Basin, Indiana*, 1994-96, U.S. Geological Survey, Fact Sheet 058-97.

Federal Register. September 26, 2001. 66,187, 2001.

Fowler K, Wilson J. 1996. *Low-Flow Characteristics of Indiana Streams*, U.S. Geological Survey, Water-Resources Investigations Report 96-4128.

Grady S. 1998. *A Study of Pesticides Concentrations in the Whitewater River and White River Basins.* Indiana Department of Environmental Management, Office of Water Management, Assessment Branch, Surveys Section, Indianapolis, Indiana. IDEM 032/02/011/1998.

Greeman TK. 1994. *Upper Wabash River Basin,* Fenelon JM. (Compiler). U.S. Geological Survey, Boday KE (Compiler). *Hydrogeologic atlas of aquifers in Indiana.* Water Resources Investigations. WRI 92-4142. p 63-84.

[IDEM] Indiana Department of Environmental Management. 1996. *Surface Water Quality Monitoring Strategy 1996 - 2000. Revised May 1998*. Indiana Department of Environmental Management, Office of Water Management, Assessment Branch. 20 p, 3 ap. IDEM 32/01/013/1996.

[IDNR] Indiana Department of Natural Resources. 1980. *The Indiana Water Resource, Availability, Uses, and Needs.* Indiana Department of Natural Resources, Division of Water.

[IDNR] Indiana Department of Natural Resources. 1990. *Water Resource Availability in the Kankakee River Basin, Indiana*. Indiana Department of Natural Resources, Division of Water.

Laws S, Ferrell J, Stoker T, Schmid J, Cooper R. 2000. *The Effects of Atrazine on Female*

Wistar Rats: An Evaluation of the Protocol for Assessing Pubertal Development and Thyroid Function. Toxicological Sciences **58,** 366-376.

McDuffee R. 2001. *An Assessment of Pesticide Concentrations in the Upper Wabash River Basin*. Indiana Department of Environmental Management, Office of Water Quality, Assessment Branch, Surveys Section, Indianapolis, Indiana. IDEM 032/02/024/2001

[NASS] National Agricultural Statistics Service. 2000. *Agricultural Chemical Usage 1999 Field Crops Summary*

Oregon State University. 1996. Extension Toxicology Network Page. http://ace.orst.edu/info/extoxnet/pips/terbufos.htm

[ORSANCO] Ohio River Valley Water Sanitation Commission. 1997. *Herbicides in the Lower Ohio River Basin*

Scheeringa K. 2000. Indiana Climate Page. http://shadow.agry.purdue.edu/toolbox/cdmap.gif. April 2000.

Thomson WT. 1993. *Agricultural Chemicals. Book II: Herbicides.* Thomson Publications, Fresno, CA.

[USGS] U.S. Geological Survey. 1994. *USGS land use and land cover (LULC) date geospatial data presentation form: Map: Sioux Falls, South Dakota.* U.S. Geological Survey

APPENDIX A
Laboratory Results

Site Name	Date Sampled	Sample Number	Parameter	Conc. µg/L	Dilution factor	Report Limit µg/L
Iroquois River at Rosebud						
UMI020-0002	5/6/1999	DA13067	Acetochlor	0.3	1	0.1
UMI020-0002	4/29/1999	DA13041	Atrazine (Aatrex)	0.7	4	0.1
UMI020-0002	5/6/1999	DA13067	Atrazine (Aatrex)	0.5	4	0.1
UMI020-0002	5/12/1999	DA13093	Atrazine (Aatrex)	0.5	1	0.1
UMI020-0002	5/19/1999	DA13119	Atrazine (Aatrex)	0.5	1	0.1
UMI020-0002	5/19/1999	DA13119	Cyanazine (Bladex)	0.6	10	1
UMI020-0002	4/7/1999	DA13017	Di-n-butylphthalate	21	1	0.1
UMI020-0002	4/29/1999	DA13041	Metolachlor	0.7	4	0.1
UMI020-0002	5/6/1999	DA13067	Metolachlor	0.3	1	0.1
Iiroquois River near Foresman						
UMI040-0001	4/29/1999	DA13040	Acetochlor	0.2	1	0.1
UMI040-0001	5/6/1999	DA13066	Acetochlor	0.2	4	0.1
UMI040-0001	6/3/1999	DA13170	Acetochlor	0.5	4	0.1
UMI040-0001	4/29/1999	DA13040	Atrazine (Aatrex)	0.5	4	0.1
UMI040-0001	5/6/1999	DA13066	Atrazine (Aatrex)	0.3	4	0.1
UMI040-0001	5/19/1999	DA13118	Atrazine (Aatrex)	0.4	4	0.1
UMI040-0001	6/3/1999	DA13170	Atrazine (Aatrex)	2.1	4	0.1
UMI040-0001	6/16/1999	DA13222	Atrazine (Aatrex)	1.3	4	0.1
UMI040-0001	6/30/1999	DA13274	Atrazine (Aatrex)	0.5	1	0.1
UMI040-0001	7/21/1999	DA13352	Atrazine (Aatrex)	0.4	1	0.1
UMI040-0001	5/6/1999	DA13066	Cyanazine (Bladex)	0.1	1	0.1
UMI040-0001	4/7/1999	DA13016	Di-n-butylphthalate	25	1	0.1
UMI040-0001	4/29/1999	DA13040	Metolachlor	0.2	10	1
UMI040-0001	6/3/1999	DA13170	Metolachlor	0.9	1	0.1
Kankakee River at Davis						
UMK040-0003	5/27/1999	DA13149	Atrazine (Aatrex)	0.6	10	1
UMK040-0003	4/7/1999	DA13021	Di-n-butylphthalate	28	4	0.1
Yellow River at Knox						
UMK060-0001	5/27/1999	DA13150	Acetochlor	1	4	0.1
UMK060-0001	6/4/1999	DA13176	Acetochlor	1.1	4	1
UMK060-0001	6/16/1999	DA13228	Acetochlor	0.7	4	1
UMK060-0001	5/27/1999	DA13150	Alachlor	0.4	4	0.1
UMK060-0001	6/16/1999	DA13228	Alachlor	0.7	4	0.1
UMK060-0001	5/27/1999	DA13150	Atrazine (Aatrex)	3.4	4	0.1
UMK060-0001	6/4/1999	DA13176	Atrazine (Aatrex)	3.8	4	0.1
UMK060-0001	6/16/1999	DA13228	Atrazine (Aatrex)	3.3	4	0.1
UMK060-0001	6/30/1999	DA13280	Atrazine (Aatrex)	0.8	4	0.1
UMK060-0001	6/4/1999	DA13176	Cyanazine (Bladex)	0.5	4	0.1

Site Name	Date Sampled	Sample Number	Parameter	Conc. µg/L	Dilution factor	Report Limit µg/L
UMK060-0001	6/30/1999	DA13280	Di(2-ethylhexyl)phthalate	4	4	0.1
UMK060-0001	7/8/1999	DA13306	Di(2-ethylhexyl)phthalate	4.5	4	0.1
Kankakee River at Dunns Bridge						
UMK080-0001	5/26/1999	DA13148	Acetochlor	2.4	4	0.1
UMK080-0001	5/26/1999	DA13148	Alachlor	0.5	4	0.1
UMK080-0001	5/26/1999	DA13148	Atrazine (Aatrex)	6.2	4	0.1
UMK080-0001	6/16/1999	DA13226	Atrazine (Aatrex)	0.8	4	0.1
UMK080-0001	4/7/1999	DA13020	Di-n-butylphthalate	24	10	1
Kankakee River at Shelby						
UMK110-0002	6/16/1999	DA13225	Atrazine (Aatrex)	0.7	4	0.1
UMK110-0002	4/7/1999	DA13019	Di-n-butylphthalate	28	1	0.1
UMK110-0002	4/29/1999	DA13043	Metolachlor	0.1	10	1
Singleton Ditch at Schneider						
UMK130-0001	5/6/1999	DA13068	Acetochlor	0.2	1	0.1
UMK130-0001	5/12/1999	DA13094	Acetochlor	0.5	4	0.1
UMK130-0001	6/3/1999	DA13172	Acetochlor	1.1	1	0.1
UMK130-0001	6/16/1999	DA13224	Acetochlor	0.6	4	0.1
UMK130-0001	4/29/1999	DA13042	Atrazine (Aatrex)	0.1	10	1
UMK130-0001	5/6/1999	DA13068	Atrazine (Aatrex)	0.1	4	0.1
UMK130-0001	5/12/1999	DA13094	Atrazine (Aatrex)	0.4	4	0.1
UMK130-0001	5/26/1999	DA13146	Atrazine (Aatrex)	0.4	4	0.1
UMK130-0001	6/3/1999	DA13172	Atrazine (Aatrex)	4.4	4	0.1
UMK130-0001	6/16/1999	DA13224	Atrazine (Aatrex)	3.3	4	0.1
UMK130-0001	6/30/1999	DA13276	Atrazine (Aatrex)	0.6	4	0.1
UMK130-0001	4/29/1999	DA13042	Cyanazine (Bladex)	0.1	4	0.1
UMK130-0001	6/16/1999	DA13224	Cyanazine (Bladex)	0.6	1	0.1
UMK130-0001	4/7/1999	DA13018	Di-n-butylphthalate	37	1	0.1
UMK130-0001	4/29/1999	DA13042	Metolachlor	0.1	1	0.1
UMK130-0001	6/3/1999	DA13172	Metolachlor	1	4	0.1
UMK130-0001	6/16/1999	DA13224	Metolachlor	0.5	4	0.1
Wabash River at Terre Haute						
WBU040-0003	4/27/1999	DA13031	Acetochlor	0.2	1	0.1
WBU040-0003	5/17/1999	DA13109	Acetochlor	0.5	4	0.1
WBU040-0003	5/24/1999	DA13135	Acetochlor	0.5	4	0.1
WBU040-0003	6/7/1999	DA13187	Acetochlor	0.5	4	0.1
WBU040-0003	6/21/1999	DA13239	Acetochlor	0.4	4	0.1
WBU040-0003	4/27/1999	DA13031	Atrazine (Aatrex)	0.8	4	0.1
WBU040-0003	5/3/1999	DA13057	Atrazine (Aatrex)	0.4	4	0.1
WBU040-0003	5/10/1999	DA13083	Atrazine (Aatrex)	0.6	1	0.1
WBU040-0003	5/17/1999	DA13109	Atrazine (Aatrex)	1.5	1	0.1
WBU040-0003	5/24/1999	DA13135	Atrazine (Aatrex)	3.5	1	0.1
WBU040-0003	6/1/1999	DA13161	Atrazine (Aatrex)	2	1	0.1

Site Name	Date Sampled	Sample Number	Parameter	Conc. µg/L	Dilution factor	Report Limit µg/L
WBU040-0003	6/7/1999	DA13187	Atrazine (Aatrex)	3.1	4	0.1
WBU040-0003	6/14/1999	DA13213	Atrazine (Aatrex)	1.7	4	0.1
WBU040-0003	6/21/1999	DA13239	Atrazine (Aatrex)	2.2	1	0.1
WBU040-0003	6/28/1999	DA13265	Atrazine (Aatrex)	1	4	0.1
WBU040-0003	7/6/1999	DA13291	Atrazine (Aatrex)	0.8	4	0.1
WBU040-0003	7/12/1999	DA13317	Atrazine (Aatrex)	1	4	0.1
WBU040-0003	7/19/1999	DA13343	Atrazine (Aatrex)	0.7	4	0.1
WBU040-0003	7/26/1999	DA13369	Atrazine (Aatrex)	0.7	4	0.1
WBU040-0003	4/27/1999	DA13031	Bromacil	0.3	4	0.1
WBU040-0003	4/27/1999	DA13031	Metolachlor	0.4	4	0.1
WBU040-0003	5/3/1999	DA13057	Metolachlor	0.3	4	0.1
WBU040-0003	5/17/1999	DA13109	Metolachlor	0.6	4	0.1
WBU040-0003	5/24/1999	DA13135	Metolachlor	0.8	4	0.1
WBU040-0003	6/1/1999	DA13161	Metolachlor	0.6	4	0.1
WBU040-0003	6/7/1999	DA13187	Metolachlor	1	4	0.1
WBU040-0003	6/21/1999	DA13239	Metolachlor	0.7	4	0.1
Wabash River at Riverton						
WBU150-0002	5/17/1999	DA13108	Acetochlor	1.2	4	0.1
WBU150-0002	5/24/1999	DA13134	Acetochlor	0.5	4	0.1
WBU150-0002	6/1/1999	DA13160	Acetochlor	0.6	4	0.1
WBU150-0002	6/7/1999	DA13186	Acetochlor	0.7	4	0.1
WBU150-0002	6/14/1999	DA13212	Acetochlor	0.4	4	0.1
WBU150-0002	5/3/1999	DA13056	Atrazine (Aatrex)	0.4	4	0.1
WBU150-0002	5/10/1999	DA13082	Atrazine (Aatrex)	0.4	4	0.1
WBU150-0002	5/17/1999	DA13108	Atrazine (Aatrex)	6.7	4	0.1
WBU150-0002	5/24/1999	DA13134	Atrazine (Aatrex)	2.2	1	0.1
WBU150-0002	6/1/1999	DA13160	Atrazine (Aatrex)	5.6	4	0.1
WBU150-0002	6/7/1999	DA13186	Atrazine (Aatrex)	4.6	4	0.1
WBU150-0002	6/14/1999	DA13212	Atrazine (Aatrex)	3.7	1	0.1
WBU150-0002	6/28/1999	DA13264	Atrazine (Aatrex)	1	4	0.1
WBU150-0002	7/6/1999	DA13290	Atrazine (Aatrex)	0.8	4	0.1
WBU150-0002	7/12/1999	DA13316	Atrazine (Aatrex)	0.7	4	0.1
WBU150-0002	7/19/1999	DA13342	Atrazine (Aatrex)	0.8	4	0.1
WBU150-0002	7/26/1999	DA13368	Atrazine (Aatrex)	0.7	4	0.1
WBU150-0002	5/17/1999	DA13108	Cyanazine (Bladex)	0.4	4	0.1
WBU150-0002	5/3/1999	DA13056	Metolachlor	0.3	4	0.1
WBU150-0002	5/17/1999	DA13108	Metolachlor	1.7	4	0.1
WBU150-0002	5/24/1999	DA13134	Metolachlor	0.5	4	0.1
WBU150-0002	6/1/1999	DA13160	Metolachlor	1.5	4	0.1
WBU150-0002	6/7/1999	DA13186	Metolachlor	1.4	4	0.1
WBU150-0002	6/14/1999	DA13212	Metolachlor	0.4	4	0.1
WBU150-0002	7/19/1999	DA13342	Prometryn	0.4	4	0.1

Site Name	Date Sampled	Sample Number	Parameter	Conc. µg/L	Dilution factor	Report Limit µg/L
WBU150-0002	7/19/1999	DA13342	Terbutryn	0.5	4	0.1
Busseron Creek near Carlisle						
WBU160-0002	4/27/1999	DA13029	Acetochlor	0.1	11	1
WBU160-0002	5/17/1999	DA13107	Acetochlor	1.2	1	0.1
WBU160-0002	5/24/1999	DA13133	Acetochlor	3.2	4	0.1
WBU160-0002	6/1/1999	DA13159	Acetochlor	0.6	4	0.1
WBU160-0002	6/7/1999	DA13185	Acetochlor	1.5	4	0.1
WBU160-0002	6/14/1999	DA13211	Acetochlor	1.5	4	0.1
WBU160-0002	6/21/1999	DA13237	Acetochlor	0.5	4	0.1
WBU160-0002	6/28/1999	DA13263	Acetochlor	0.6	4	0.1
WBU160-0002	6/14/1999	DA13211	Alachlor	0.4	1	0.1
WBU160-0002	4/6/1999	DA13005	Atrazine (Aatrex)	73	1	0.1
WBU160-0002	4/27/1999	DA13029	Atrazine (Aatrex)	1.5	1	0.1
WBU160-0002	5/3/1999	DA13055	Atrazine (Aatrex)	0.4	1	0.1
WBU160-0002	5/10/1999	DA13081	Atrazine (Aatrex)	0.5	1	0.1
WBU160-0002	5/17/1999	DA13107	Atrazine (Aatrex)	3	4	0.1
WBU160-0002	5/24/1999	DA13133	Atrazine (Aatrex)	10	11	0.1
WBU160-0002	6/1/1999	DA13159	Atrazine (Aatrex)	2.5	4	0.1
WBU160-0002	6/7/1999	DA13185	Atrazine (Aatrex)	7.7	11	0.1
WBU160-0002	6/14/1999	DA13211	Atrazine (Aatrex)	9.6	1	0.1
WBU160-0002	6/21/1999	DA13237	Atrazine (Aatrex)	3.1	4	0.1
WBU160-0002	6/28/1999	DA13263	Atrazine (Aatrex)	4.1	4	0.1
WBU160-0002	7/6/1999	DA13289	Atrazine (Aatrex)	2.5	4	0.1
WBU160-0002	7/12/1999	DA13315	Atrazine (Aatrex)	1.7	4	0.1
WBU160-0002	7/19/1999	DA13341	Atrazine (Aatrex)	2	4	0.1
WBU160-0002	7/26/1999	DA13367	Atrazine (Aatrex)	1	4	0.1
WBU160-0002	4/27/1999	DA13029	Bromacil	0.2	4	0.1
WBU160-0002	7/19/1999	DA13341	Chloroneb	0.4	4	0.1
WBU160-0002	4/6/1999	DA13005	Dimethylphthalate	13	4	0.1
WBU160-0002	4/6/1999	DA13005	Metolachlor	1.4	4	0.1
WBU160-0002	4/27/1999	DA13029	Metolachlor	0.1	4	0.1
WBU160-0002	5/24/1999	DA13133	Metolachlor	0.6	4	0.1
WBU160-0002	6/7/1999	DA13185	Metolachlor	0.6	4	0.1
WBU160-0002	4/27/1999	DA13029	Simazine	0.4	4	0.1
WBU160-0002	5/3/1999	DA13055	Simazine	0.23	4	0.1
WBU160-0002	5/24/1999	DA13133	Simazine	0.66	4	0.1
Wabash River at Vincennes						
WBU200-0003	4/27/1999	DA13028	Acetochlor	0.3	4	0.1
WBU200-0003	5/4/1999	DA13054	Acetochlor	0.1	4	0.1
WBU200-0003	5/18/1999	DA13106	Acetochlor	1.2	4	0.1
WBU200-0003	5/25/1999	DA13132	Acetochlor	0.6	4	0.1
WBU200-0003	6/2/1999	DA13158	Acetochlor	1.4	4	0.1

Site Name	Date Sampled	Sample Number	Parameter	Conc. µg/L	Dilution factor	Report Limit µg/L
WBU200-0003	6/8/1999	DA13184	Acetochlor	0.9	4	0.1
WBU200-0003	6/21/1999	DA13236	Acetochlor	0.5	1	0.1
WBU200-0003	4/5/1999	DA13004	Atrazine (Aatrex)	11	4	1
WBU200-0003	4/27/1999	DA13028	Atrazine (Aatrex)	1.5	4	0.1
WBU200-0003	5/4/1999	DA13054	Atrazine (Aatrex)	0.5	4	0.1
WBU200-0003	5/11/1999	DA13080	Atrazine (Aatrex)	0.4	4	0.1
WBU200-0003	5/18/1999	DA13106	Atrazine (Aatrex)	6.9	4	0.1
WBU200-0003	5/25/1999	DA13132	Atrazine (Aatrex)	2.6	4	0.1
WBU200-0003	6/2/1999	DA13158	Atrazine (Aatrex)	11	4	0.1
WBU200-0003	6/8/1999	DA13184	Atrazine (Aatrex)	6.3	4	0.1
WBU200-0003	6/14/1999	DA13210	Atrazine (Aatrex)	2.9	4	0.1
WBU200-0003	6/21/1999	DA13236	Atrazine (Aatrex)	2.7	1	0.1
WBU200-0003	6/28/1999	DA13262	Atrazine (Aatrex)	1.7	4	0.1
WBU200-0003	7/6/1999	DA13288	Atrazine (Aatrex)	0.9	1	0.1
WBU200-0003	7/12/1999	DA13314	Atrazine (Aatrex)	0.7	4	0.1
WBU200-0003	7/19/1999	DA13340	Atrazine (Aatrex)	0.7	1	0.1
WBU200-0003	7/26/1999	DA13366	Atrazine (Aatrex)	0.7	1	0.1
WBU200-0003	4/27/1999	DA13028	Cyanazine (Bladex)	0.2	1	0.1
WBU200-0003	6/2/1999	DA13158	Di(2-ethylhexyl)phthalate	2.6	1	0.1
WBU200-0003	4/5/1999	DA13004	Metolachlor	1.3	1	0.1
WBU200-0003	4/27/1999	DA13028	Metolachlor	0.7	10	0.1
WBU200-0003	5/4/1999	DA13054	Metolachlor	0.3	10	0.1
WBU200-0003	5/18/1999	DA13106	Metolachlor	1.5	10	0.1
WBU200-0003	5/25/1999	DA13132	Metolachlor	0.5	4	0.1
WBU200-0003	6/2/1999	DA13158	Metolachlor	1.7	4	0.1
WBU200-0003	6/8/1999	DA13184	Metolachlor	1.7	1	0.1
WBU200-0003	6/14/1999	DA13210	Metolachlor	0.5	4	0.1
WBU200-0003	6/21/1999	DA13236	Metolachlor	0.9	4	0.1
WBU200-0003	4/5/1999	DA13004	Simazine	3.5	4	0.1
WBU200-0003	4/27/1999	DA13028	Simazine	0.1	4	0.1
WBU200-0003	5/4/1999	DA13054	Simazine	0.08	4	0.1
WBU200-0003	5/18/1999	DA13106	Simazine	0.32	4	0.1
WBU200-0003	6/2/1999	DA13158	Simazine	0.44	4	0.1
Wabash River at Lafayette						
WLV010-0002	4/26/1999	DA13039	Acetochlor	0.1	11	1
WLV010-0002	5/6/1999	DA13065	Acetochlor	0.1	4	0.1
WLV010-0002	5/19/1999	DA13117	Acetochlor	1	4	0.1
WLV010-0002	5/26/1999	DA13143	Acetochlor	1.2	4	0.1
WLV010-0002	6/3/1999	DA13169	Acetochlor	1.2	4	0.1
WLV010-0002	6/9/1999	DA13195	Acetochlor	0.4	4	0.1
WLV010-0002	6/16/1999	DA13221	Acetochlor	0.7	4	0.1
WLV010-0002	4/26/1999	DA13039	Atrazine (Aatrex)	0.4	4	0.1

Site Name	Date Sampled	Sample Number	Parameter	Conc. µg/L	Dilution factor	Report Limit µg/L
WLV010-0002	5/6/1999	DA13065	Atrazine (Aatrex)	0.3	1	0.1
WLV010-0002	5/19/1999	DA13117	Atrazine (Aatrex)	2.8	4	0.1
WLV010-0002	5/26/1999	DA13143	Atrazine (Aatrex)	6.5	1	0.1
WLV010-0002	6/3/1999	DA13169	Atrazine (Aatrex)	5.6	1	0.1
WLV010-0002	6/9/1999	DA13195	Atrazine (Aatrex)	1.9	1	0.1
WLV010-0002	6/16/1999	DA13221	Atrazine (Aatrex)	5.1	1	0.1
WLV010-0002	6/23/1999	DA13247	Atrazine (Aatrex)	1.5	1	0.1
WLV010-0002	6/30/1999	DA13273	Atrazine (Aatrex)	1.2	1	0.1
WLV010-0002	7/8/1999	DA13299	Atrazine (Aatrex)	1.9	4	0.1
WLV010-0002	7/14/1999	DA13325	Atrazine (Aatrex)	1.1	4	0.1
WLV010-0002	7/21/1999	DA13351	Atrazine (Aatrex)	1.2	4	0.1
WLV010-0002	7/28/1999	DA13377	Atrazine (Aatrex)	1	1	0.1
WLV010-0002	4/26/1999	DA13039	Bromacil	0.1	4	0.1
WLV010-0002	5/26/1999	DA13143	Cyanazine (Bladex)	0.4	4	0.1
WLV010-0002	4/6/1999	DA13015	Di-n-butylphthalate	35	4	0.1
WLV010-0002	4/26/1999	DA13039	Metolachlor	0.2	4	0.1
WLV010-0002	5/6/1999	DA13065	Metolachlor	0.2	4	0.1
WLV010-0002	5/19/1999	DA13117	Metolachlor	0.7	4	0.1
WLV010-0002	5/26/1999	DA13143	Metolachlor	1.5	4	0.1
WLV010-0002	6/3/1999	DA13169	Metolachlor	2.2	4	0.1
WLV010-0002	6/9/1999	DA13195	Metolachlor	0.5	4	0.1
WLV010-0002	6/16/1999	DA13221	Metolachlor	1.6	4	0.1
WLV010-0002	4/26/1999	DA13039	Simazine	0.08	4	0.1
WLV010-0002	5/26/1999	DA13143	Simazine	0.3	4	0.1
WLV010-0002	6/16/1999	DA13221	Simazine	0.36	4	0.1
Wabash River at Covington						
WLV080-0005	4/26/1999	DA13037	Acetochlor	0.1	4	0.1
WLV080-0005	5/5/1999	DA13063	Acetochlor	0.1	4	0.1
WLV080-0005	5/26/1999	DA13141	Acetochlor	0.5	1	0.1
WLV080-0005	6/3/1999	DA13167	Acetochlor	0.7	1	0.1
WLV080-0005	6/8/1999	DA13193	Acetochlor	0.6	1	0.1
WLV080-0005	6/22/1999	DA13245	Acetochlor	0.5	1	0.1
WLV080-0005	4/26/1999	DA13037	Atrazine (Aatrex)	0.6	4	0.1
WLV080-0005	5/5/1999	DA13063	Atrazine (Aatrex)	0.4	4	0.1
WLV080-0005	5/19/1999	DA13115	Atrazine (Aatrex)	0.9	4	0.1
WLV080-0005	5/26/1999	DA13141	Atrazine (Aatrex)	2.3	1	0.1
WLV080-0005	6/3/1999	DA13167	Atrazine (Aatrex)	6.4	4	0.1
WLV080-0005	6/8/1999	DA13193	Atrazine (Aatrex)	3.8	1	0.1
WLV080-0005	6/15/1999	DA13219	Atrazine (Aatrex)	2.5	1	0.1
WLV080-0005	6/22/1999	DA13245	Atrazine (Aatrex)	2.1	4	0.1
WLV080-0005	6/29/1999	DA13271	Atrazine (Aatrex)	1.4	4	0.1
WLV080-0005	7/7/1999	DA13297	Atrazine (Aatrex)	1.4	4	0.1

Site Name	Date Sampled	Sample Number	Parameter	Conc. µg/L	Dilution factor	Report Limit µg/L
WLV080-0005	7/13/1999	DA13323	Atrazine (Aatrex)	1.1	4	0.1
WLV080-0005	7/20/1999	DA13349	Atrazine (Aatrex)	1	4	0.1
WLV080-0005	7/27/1999	DA13375	Atrazine (Aatrex)	0.9	4	0.1
WLV080-0005	4/26/1999	DA13037	Bromacil	0.2	4	0.1
WLV080-0005	4/26/1999	DA13037	Metolachlor	0.3	4	0.1
WLV080-0005	5/5/1999	DA13063	Metolachlor	0.2	4	0.1
WLV080-0005	5/26/1999	DA13141	Metolachlor	0.7	4	0.1
WLV080-0005	6/3/1999	DA13167	Metolachlor	2	4	0.1
WLV080-0005	6/8/1999	DA13193	Metolachlor	0.9	4	0.1
WLV080-0005	6/15/1999	DA13219	Metolachlor	0.8	4	0.1
WLV080-0005	6/22/1999	DA13245	Metolachlor	0.4	4	0.1
Wabash River at Montezuma						
WLV150-0001	4/26/1999	DA13033	Acetochlor	0.1	4	0.1
WLV150-0001	5/25/1999	DA13137	Acetochlor	0.4	1	0.1
WLV150-0001	6/2/1999	DA13163	Acetochlor	0.6	4	0.1
WLV150-0001	6/8/1999	DA13189	Acetochlor	0.5	4	0.1
WLV150-0001	6/22/1999	DA13241	Acetochlor	0.4	4	0.1
WLV150-0001	4/26/1999	DA13033	Atrazine (Aatrex)	0.7	4	0.1
WLV150-0001	5/4/1999	DA13059	Atrazine (Aatrex)	0.3	4	0.1
WLV150-0001	5/11/1999	DA13085	Atrazine (Aatrex)	0.4	1	0.1
WLV150-0001	5/18/1999	DA13111	Atrazine (Aatrex)	1	1	0.1
WLV150-0001	5/25/1999	DA13137	Atrazine (Aatrex)	2	1	0.1
WLV150-0001	6/2/1999	DA13163	Atrazine (Aatrex)	2.8	1	0.1
WLV150-0001	6/8/1999	DA13189	Atrazine (Aatrex)	2.7	4	0.1
WLV150-0001	6/15/1999	DA13215	Atrazine (Aatrex)	3.1	4	0.1
WLV150-0001	6/22/1999	DA13241	Atrazine (Aatrex)	2	1	0.1
WLV150-0001	6/29/1999	DA13267	Atrazine (Aatrex)	1.2	4	0.1
WLV150-0001	7/7/1999	DA13293	Atrazine (Aatrex)	0.9	4	0.1
WLV150-0001	7/13/1999	DA13319	Atrazine (Aatrex)	0.6	4	0.1
WLV150-0001	7/20/1999	DA13345	Atrazine (Aatrex)	0.8	4	0.1
WLV150-0001	7/27/1999	DA13371	Atrazine (Aatrex)	0.7	4	0.1
WLV150-0001	4/26/1999	DA13033	Bromacil	0.2	4	0.1
WLV150-0001	4/26/1999	DA13033	Metolachlor	0.4	4	0.1
WLV150-0001	5/4/1999	DA13059	Metolachlor	0.2	4	0.1
WLV150-0001	5/18/1999	DA13111	Metolachlor	0.4	4	0.1
WLV150-0001	5/25/1999	DA13137	Metolachlor	0.7	4	0.1
WLV150-0001	6/2/1999	DA13163	Metolachlor	0.7	4	0.1
WLV150-0001	6/8/1999	DA13189	Metolachlor	0.7	4	0.1
WLV150-0001	6/15/1999	DA13215	Metolachlor	0.6	4	0.1
WLV150-0001	6/22/1999	DA13241	Metolachlor	0.5	4	0.1
Big Raccoon Creek near Fincastle						
WLV160-0002	5/18/1999	DA13113	Acetochlor	0.6	1	0.1

Site Name	Date Sampled	Sample Number	Parameter	Conc. µg/L	Dilution factor	Report Limit µg/L
WLV160-0002	6/2/1999	DA13165	Acetochlor	0.6	4	0.1
WLV160-0002	4/27/1999	DA13035	Atrazine (Aatrex)	0.5	4	0.1
WLV160-0002	5/4/1999	DA13061	Atrazine (Aatrex)	0.1	4	1
WLV160-0002	5/18/1999	DA13113	Atrazine (Aatrex)	9.9	4	0.1
WLV160-0002	5/25/1999	DA13139	Atrazine (Aatrex)	1.7	4	0.1
WLV160-0002	6/2/1999	DA13165	Atrazine (Aatrex)	6.7	1	0.1
WLV160-0002	6/8/1999	DA13191	Atrazine (Aatrex)	0.5	1	0.1
WLV160-0002	6/15/1999	DA13217	Atrazine (Aatrex)	1	4	0.1
WLV160-0002	7/7/1999	DA13295	Atrazine (Aatrex)	0.4	4	0.1
WLV160-0002	7/13/1999	DA13321	Atrazine (Aatrex)	0.4	1	0.1
WLV160-0002	7/20/1999	DA13347	Atrazine (Aatrex)	0.4	4	0.1
WLV160-0002	7/27/1999	DA13373	Atrazine (Aatrex)	0.5	4	0.1
WLV160-0002	7/13/1999	DA13321	Chloroneb	0.8	4	0.1
WLV160-0002	7/20/1999	DA13347	Chloroneb	0.5	4	0.1
WLV160-0002	4/6/1999	DA13011	Di-n-butylphthalate	32	4	0.1
WLV160-0002	5/18/1999	DA13113	Di-n-butylphthalate	13	10	1
WLV160-0002	4/27/1999	DA13035	Metolachlor	0.2	4	0.1
WLV160-0002	5/4/1999	DA13061	Metolachlor	0.1	4	0.1
WLV160-0002	5/18/1999	DA13113	Metolachlor	4.9	4	0.1
WLV160-0002	5/25/1999	DA13139	Metolachlor	0.5	4	0.1
WLV160-0002	6/2/1999	DA13165	Metolachlor	2.8	4	0.1
WLV160-0002	6/15/1999	DA13217	Metolachlor	0.6	4	0.1
Big Raccoon Creek at Ferndale						
WLV170-0003	4/27/1999	DA13034	Acetochlor	0.1	4	0.1
WLV170-0003	5/4/1999	DA13060	Alachlor	0.1	4	0.1
WLV170-0003	4/27/1999	DA13034	Atrazine (Aatrex)	1.9	4	0.1
WLV170-0003	4/27/1999	DA13047	Atrazine (Aatrex)	0.8	4	0.1
WLV170-0003	5/4/1999	DA13060	Atrazine (Aatrex)	0.9	4	0.1
WLV170-0003	5/4/1999	DA13073	Atrazine (Aatrex)	1.7	4	0.1
WLV170-0003	5/11/1999	DA13086	Atrazine (Aatrex)	1.3	4	0.1
WLV170-0003	5/18/1999	DA13112	Atrazine (Aatrex)	1.2	4	0.1
WLV170-0003	5/25/1999	DA13138	Atrazine (Aatrex)	1.6	4	0.1
WLV170-0003	5/25/1999	DA13151	Atrazine (Aatrex)	1.5	4	0.1
WLV170-0003	6/2/1999	DA13164	Atrazine (Aatrex)	0.8	4	0.1
WLV170-0003	6/2/1999	DA13177	Atrazine (Aatrex)	0.7	4	0.1
WLV170-0003	6/8/1999	DA13190	Atrazine (Aatrex)	0.9	4	0.1
WLV170-0003	6/15/1999	DA13216	Atrazine (Aatrex)	1.4	4	0.1
WLV170-0003	6/22/1999	DA13242	Atrazine (Aatrex)	1.5	4	0.1
WLV170-0003	6/22/1999	DA13255	Atrazine (Aatrex)	1.3	4	0.1
WLV170-0003	6/29/1999	DA13268	Atrazine (Aatrex)	1.7	4	0.1
WLV170-0003	6/29/1999	DA13281	Atrazine (Aatrex)	1.7	4	0.1
WLV170-0003	7/7/1999	DA13294	Atrazine (Aatrex)	1.9	1	0.1

Site Name	Date Sampled	Sample Number	Parameter	Conc. µg/L	Dilution factor	Report Limit µg/L
WLV170-0003	7/7/1999	DA13307	Atrazine (Aatrex)	1.1	1	0.1
WLV170-0003	7/13/1999	DA13320	Atrazine (Aatrex)	1.7	4	0.1
WLV170-0003	7/20/1999	DA13346	Atrazine (Aatrex)	1.5	1	0.1
WLV170-0003	7/20/1999	DA13359	Atrazine (Aatrex)	2.1	1	0.1
WLV170-0003	7/27/1999	DA13372	Atrazine (Aatrex)	2	1	0.1
WLV170-0003	7/27/1999	DA13385	Atrazine (Aatrex)	1.5	1	0.1
WLV170-0003	4/6/1999	DA13010	Di-n-butylphthalate	78	1	0.1
WLV170-0003	4/27/1999	DA13034	Metolachlor	0.8	1	0.1
WLV170-0003	4/27/1999	DA13047	Metolachlor	0.6	4	0.1
WLV170-0003	5/4/1999	DA13060	Metolachlor	0.5	1	0.1
WLV170-0003	5/4/1999	DA13073	Metolachlor	0.5	4	0.1
WLV170-0003	5/18/1999	DA13112	Metolachlor	0.4	1	0.1
WLV170-0003	5/25/1999	DA13138	Metolachlor	0.5	4	0.1
WLV170-0003	5/25/1999	DA13151	Metolachlor	0.5	4	0.1
WLV170-0003	6/22/1999	DA13242	Metolachlor	0.5	1	0.1
WLV170-0003	6/29/1999	DA13268	Metolachlor	0.5	4	0.1
WLV170-0003	6/29/1999	DA13281	Metolachlor	0.5	4	0.1
WLV170-0003	7/7/1999	DA13294	Metolachlor	0.5	4	0.1
WLV170-0003	7/7/1999	DA13307	Metolachlor	0.6	4	0.1
WLV170-0003	7/13/1999	DA13320	Metolachlor	0.5	4	0.1
WLV170-0003	7/20/1999	DA13346	Metolachlor	0.6	4	0.1
WLV170-0003	7/20/1999	DA13359	Metolachlor	0.6	4	0.1
WLV170-0003	7/27/1999	DA13372	Metolachlor	0.7	4	0.1
WLV170-0003	7/27/1999	DA13385	Metolachlor	0.6	4	0.1
WLV170-0003	5/4/1999	DA13073	Simazine	0.07	4	0.1
Big Raccoon Creek at Coxville						
WLV190-0003	4/27/1999	DA13032	Acetochlor	0.2	4	0.1
WLV190-0003	6/2/1999	DA13162	Acetochlor	0.7	4	0.1
WLV190-0003	4/27/1999	DA13032	Atrazine (Aatrex)	2.1	4	0.1
WLV190-0003	5/4/1999	DA13058	Atrazine (Aatrex)	1.1	4	0.1
WLV190-0003	5/11/1999	DA13084	Atrazine (Aatrex)	0.6	4	0.1
WLV190-0003	5/18/1999	DA13110	Atrazine (Aatrex)	1	4	0.1
WLV190-0003	5/25/1999	DA13136	Atrazine (Aatrex)	4	4	0.1
WLV190-0003	6/2/1999	DA13162	Atrazine (Aatrex)	5.3	4	0.1
WLV190-0003	6/8/1999	DA13188	Atrazine (Aatrex)	1.6	1	0.1
WLV190-0003	6/15/1999	DA13214	Atrazine (Aatrex)	1.4	1	0.1
WLV190-0003	6/22/1999	DA13240	Atrazine (Aatrex)	0.7	4	0.1
WLV190-0003	6/29/1999	DA13266	Atrazine (Aatrex)	1	4	1
WLV190-0003	7/20/1999	DA13344	Atrazine (Aatrex)	0.9	1	0.1
WLV190-0003	7/27/1999	DA13370	Atrazine (Aatrex)	0.6	1	0.1
WLV190-0003	4/6/1999	DA13008	Di-n-butylphthalate	78	1	0.1
WLV190-0003	4/27/1999	DA13032	Metolachlor	0.6	1	0.1

Site Name	Date Sampled	Sample Number	Parameter	Conc. µg/L	Dilution factor	Report Limit µg/L
WLV190-0003	5/4/1999	DA13058	Metolachlor	0.3	4	0.1
WLV190-0003	5/25/1999	DA13136	Metolachlor	1.1	4	0.1
WLV190-0003	6/2/1999	DA13162	Metolachlor	2	4	0.1
WLV190-0003	6/8/1999	DA13188	Metolachlor	0.5	4	0.1
WLV190-0003	4/27/1999	DA13032	Simazine	0.08	4	0.1
Wabash River at Mt. Carmel						
WLW040-0001	4/28/1999	DA13025	Acetochlor	0.4	4	0.1
WLW040-0001	5/4/1999	DA13051	Acetochlor	0.1	4	0.1
WLW040-0001	5/18/1999	DA13103	Acetochlor	0.6	4	0.1
WLW040-0001	5/25/1999	DA13129	Acetochlor	1.3	4	0.1
WLW040-0001	6/2/1999	DA13155	Acetochlor	0.4	4	0.1
WLW040-0001	6/8/1999	DA13181	Acetochlor	1.5	4	0.1
WLW040-0001	6/15/1999	DA13207	Acetochlor	0.5	4	0.1
WLW040-0001	6/22/1999	DA13233	Acetochlor	0.4	4	0.1
WLW040-0001	4/5/1999	DA13001	Atrazine (Aatrex)	89	4	0.1
WLW040-0001	4/28/1999	DA13025	Atrazine (Aatrex)	1.9	4	0.1
WLW040-0001	5/4/1999	DA13051	Atrazine (Aatrex)	0.9	4	0.1
WLW040-0001	5/11/1999	DA13077	Atrazine (Aatrex)	0.9	4	0.1
WLW040-0001	5/18/1999	DA13103	Atrazine (Aatrex)	3.5	4	0.1
WLW040-0001	5/25/1999	DA13129	Atrazine (Aatrex)	7.6	4	0.1
WLW040-0001	6/2/1999	DA13155	Atrazine (Aatrex)	2.7	10	0.1
WLW040-0001	6/8/1999	DA13181	Atrazine (Aatrex)	12	4	0.1
WLW040-0001	6/15/1999	DA13207	Atrazine (Aatrex)	5.7	4	0.1
WLW040-0001	6/22/1999	DA13233	Atrazine (Aatrex)	2.9	4	0.1
WLW040-0001	6/29/1999	DA13259	Atrazine (Aatrex)	3.4	4	0.1
WLW040-0001	7/7/1999	DA13285	Atrazine (Aatrex)	1.1	1	0.1
WLW040-0001	7/13/1999	DA13311	Atrazine (Aatrex)	0.7	4	0.1
WLW040-0001	7/20/1999	DA13337	Atrazine (Aatrex)	0.7	1	0.1
WLW040-0001	7/27/1999	DA13363	Atrazine (Aatrex)	0.7	10	1
WLW040-0001	4/5/1999	DA13001	Di(2-ethylhexyl)phthalate	25	10	1
WLW040-0001	4/5/1999	DA13001	Dimethylphthalate	12	1	0.1
WLW040-0001	4/28/1999	DA13025	Metolachlor	0.8	1	0.1
WLW040-0001	5/4/1999	DA13051	Metolachlor	0.4	1	0.1
WLW040-0001	5/18/1999	DA13103	Metolachlor	0.8	4	0.1
WLW040-0001	5/25/1999	DA13129	Metolachlor	1.1	4	0.1
WLW040-0001	6/2/1999	DA13155	Metolachlor	0.6	1	0.1
WLW040-0001	6/8/1999	DA13181	Metolachlor	2.7	1	0.1
WLW040-0001	6/15/1999	DA13207	Metolachlor	0.7	4	0.1
WLW040-0001	6/22/1999	DA13233	Metolachlor	0.8	4	0.1
WLW040-0001	6/29/1999	DA13259	Metolachlor	0.7	4	0.1
WLW040-0001	4/5/1999	DA13001	Simazine	25	4	0.1
WLW040-0001	4/28/1999	DA13025	Simazine	0.08	4	0.1

Site Name	Date Sampled	Sample Number	Parameter	Conc. µg/L	Dilution factor	Report Limit µg/L
WLW040-0001	5/4/1999	DA13051	Simazine	0.08	1	0.1
WLW040-0001	5/25/1999	DA13129	Simazine	0.34	4	0.1
WLW040-0001	6/8/1999	DA13181	Simazine	0.47	10	0.1
WLW040-0001	6/15/1999	DA13207	Simazine	0.3	4	0.1
Patoka River near Princeton						
WPA080-0002	4/28/1999	DA13026	Acetochlor	0.5	4	0.1
WPA080-0002	5/3/1999	DA13052	Acetochlor	0.5	4	0.1
WPA080-0002	5/10/1999	DA13078	Acetochlor	0.5	4	0.1
WPA080-0002	5/24/1999	DA13130	Acetochlor	0.8	4	0.1
WPA080-0002	6/1/1999	DA13156	Acetochlor	0.4	4	0.1
WPA080-0002	6/7/1999	DA13182	Acetochlor	0.9	4	0.1
WPA080-0002	6/28/1999	DA13260	Acetochlor	0.4	4	0.1
WPA080-0002	4/28/1999	DA13026	Atrazine (Aatrex)	9.5	4	0.1
WPA080-0002	5/3/1999	DA13052	Atrazine (Aatrex)	4.8	4	0.1
WPA080-0002	5/10/1999	DA13078	Atrazine (Aatrex)	5.3	4	0.1
WPA080-0002	5/17/1999	DA13104	Atrazine (Aatrex)	2.6	4	0.1
WPA080-0002	5/24/1999	DA13130	Atrazine (Aatrex)	7.3	4	0.1
WPA080-0002	6/1/1999	DA13156	Atrazine (Aatrex)	6.7	4	0.1
WPA080-0002	6/7/1999	DA13182	Atrazine (Aatrex)	24	4	0.1
WPA080-0002	6/14/1999	DA13208	Atrazine (Aatrex)	4.1	4	0.1
WPA080-0002	6/21/1999	DA13234	Atrazine (Aatrex)	1.9	4	0.1
WPA080-0002	6/28/1999	DA13260	Atrazine (Aatrex)	3.7	4	0.1
WPA080-0002	7/6/1999	DA13286	Atrazine (Aatrex)	2	4	0.1
WPA080-0002	7/12/1999	DA13312	Atrazine (Aatrex)	1.5	4	0.1
WPA080-0002	7/19/1999	DA13338	Atrazine (Aatrex)	0.7	4	0.1
WPA080-0002	7/26/1999	DA13364	Atrazine (Aatrex)	1.7	4	0.1
WPA080-0002	4/28/1999	DA13026	Cyanazine (Bladex)	1.1	4	0.1
WPA080-0002	4/28/1999	DA13026	Metolachlor	1.9	4	0.1
WPA080-0002	5/3/1999	DA13052	Metolachlor	1	1	0.1
WPA080-0002	5/10/1999	DA13078	Metolachlor	1	1	0.1
WPA080-0002	5/17/1999	DA13104	Metolachlor	0.5	1	0.1
WPA080-0002	5/24/1999	DA13130	Metolachlor	0.8	1	0.1
WPA080-0002	6/1/1999	DA13156	Metolachlor	0.6	1	0.1
WPA080-0002	6/7/1999	DA13182	Metolachlor	5.1	1	0.1
WPA080-0002	6/14/1999	DA13208	Metolachlor	1.1	1	0.1
WPA080-0002	6/21/1999	DA13234	Metolachlor	0.6	4	0.1
WPA080-0002	6/28/1999	DA13260	Metolachlor	0.4	1	0.1
WPA080-0002	7/6/1999	DA13286	Metolachlor	1	4	0.1
WPA080-0002	7/12/1999	DA13312	Metolachlor	0.7	4	0.1
WPA080-0002	4/28/1999	DA13026	Simazine	3.6	4	0.1
WPA080-0002	5/3/1999	DA13052	Simazine	1.7	4	0.1
WPA080-0002	5/10/1999	DA13078	Simazine	0.73	4	0.1

Site Name	Date Sampled	Sample Number	Parameter	Conc. µg/L	Dilution factor	Report Limit µg/L
WPA080-0002	5/24/1999	DA13130	Simazine	1.3	4	0.1
WPA080-0002	6/1/1999	DA13156	Simazine	1.4	4	0.1
WPA080-0002	6/7/1999	DA13182	Simazine	2.5	4	0.1
WPA080-0002	6/14/1999	DA13208	Simazine	0.42	4	0.1
WPA080-0002	6/28/1999	DA13260	Simazine	0.83	4	0.1
WPA080-0002	7/6/1999	DA13286	Simazine	0.5	1	0.1
WPA080-0002	7/12/1999	DA13312	Simazine	0.35	1	0.1
Prairie Creek near Lebanon						
WSU020-0004	4/6/1999	DA13014	Atrazine (Aatrex)	16	4	0.1
WSU020-0004	4/26/1999	DA13038	Atrazine (Aatrex)	0.4	4	0.1
WSU020-0004	5/5/1999	DA13064	Atrazine (Aatrex)	0.4	4	0.1
WSU020-0004	5/19/1999	DA13116	Atrazine (Aatrex)	1.3	4	0.1
WSU020-0004	5/26/1999	DA13142	Atrazine (Aatrex)	0.9	4	0.1
WSU020-0004	6/3/1999	DA13168	Atrazine (Aatrex)	4.7	4	0.1
WSU020-0004	6/9/1999	DA13194	Atrazine (Aatrex)	9.7	4	0.1
WSU020-0004	6/16/1999	DA13220	Atrazine (Aatrex)	0.8	4	0.1
WSU020-0004	6/23/1999	DA13246	Atrazine (Aatrex)	0.7	4	0.1
WSU020-0004	6/30/1999	DA13272	Atrazine (Aatrex)	1.7	4	0.1
WSU020-0004	7/8/1999	DA13298	Atrazine (Aatrex)	2.3	4	0.1
WSU020-0004	7/14/1999	DA13324	Atrazine (Aatrex)	0.4	4	0.1
WSU020-0004	7/28/1999	DA13376	Chloroneb	43	4	0.1
WSU020-0004	6/30/1999	DA13272	Chlorothalonil (Bravo)	1.1	4	0.1
WSU020-0004	7/8/1999	DA13298	Chlorothalonil (Bravo)	9.4	4	0.1
WSU020-0004	7/28/1999	DA13376	Chlorothalonil (Bravo)	56	4	0.1
WSU020-0004	4/6/1999	DA13014	Di(2-ethylhexyl)phthalate	6.7	4	0.1
WSU020-0004	4/6/1999	DA13014	Di-n-butylphthalate	91	4	0.1
WSU020-0004	5/12/1999	DA13090	Gamma-BHC (Lindane)	0.16	4	0.1
WSU020-0004	5/12/1999	DA13099	Gamma-BHC (Lindane)	0.16	4	0.1
WSU020-0004	4/6/1999	DA13014	Metolachlor	55	4	0.1
WSU020-0004	4/26/1999	DA13038	Metolachlor	0.2	4	0.1
WSU020-0004	5/5/1999	DA13064	Metolachlor	0.2	1	0.1
WSU020-0004	5/19/1999	DA13116	Metolachlor	1.1	1	0.1
WSU020-0004	5/26/1999	DA13142	Metolachlor	0.5	1	0.1
WSU020-0004	6/3/1999	DA13168	Metolachlor	2	10	0.1
WSU020-0004	6/16/1999	DA13220	Metolachlor	0.4	10	1
WSU020-0004	6/23/1999	DA13246	Metolachlor	0.6	10	1
WSU020-0004	6/30/1999	DA13272	Metolachlor	1.1	10	0.1
WSU020-0004	7/8/1999	DA13298	Metolachlor	1.5	4	0.1
WSU020-0004	7/28/1999	DA13376	Metolachlor	0.5	4	0.1
WSU020-0004	5/19/1999	DA13116	Metribuzin	0.5	4	0.1
Sugar Creek at Crawfordsville						
WSU050-0006	5/19/1999	DA13114	Acetochlor	0.5	4	0.1

Site Name	Date Sampled	Sample Number	Parameter	Conc. µg/L	Dilution factor	Report Limit µg/L
WSU050-0006	5/19/1999	DA13125	Acetochlor	0.4	4	0.1
WSU050-0006	6/3/1999	DA13166	Acetochlor	0.4	4	0.1
WSU050-0006	4/26/1999	DA13036	Atrazine (Aatrex)	0.5	4	0.1
WSU050-0006	5/5/1999	DA13062	Atrazine (Aatrex)	0.4	4	0.1
WSU050-0006	5/19/1999	DA13114	Atrazine (Aatrex)	6.3	4	0.1
WSU050-0006	5/19/1999	DA13125	Atrazine (Aatrex)	7	4	0.1
WSU050-0006	5/26/1999	DA13140	Atrazine (Aatrex)	1.3	4	0.1
WSU050-0006	6/3/1999	DA13166	Atrazine (Aatrex)	7.3	4	0.1
WSU050-0006	6/9/1999	DA13192	Atrazine (Aatrex)	1.2	4	0.1
WSU050-0006	6/16/1999	DA13218	Atrazine (Aatrex)	2.2	4	0.1
WSU050-0006	6/16/1999	DA13229	Atrazine (Aatrex)	0.9	4	0.1
WSU050-0006	6/23/1999	DA13244	Atrazine (Aatrex)	1.6	4	0.1
WSU050-0006	7/8/1999	DA13296	Atrazine (Aatrex)	1	4	0.1
WSU050-0006	7/14/1999	DA13322	Atrazine (Aatrex)	0.5	4	0.1
WSU050-0006	7/28/1999	DA13374	Atrazine (Aatrex)	0.5	4	0.1
WSU050-0006	7/14/1999	DA13322	Chloroneb	0.5	4	0.1
WSU050-0006	6/3/1999	DA13166	Clomazone	0.5	4	0.1
WSU050-0006	5/19/1999	DA13114	Di-n-butylphthalate	10	4	0.1
WSU050-0006	4/26/1999	DA13036	Metolachlor	0.2	4	1
WSU050-0006	5/5/1999	DA13062	Metolachlor	0.2	4	0.1
WSU050-0006	5/19/1999	DA13114	Metolachlor	2.4	4	0.1
WSU050-0006	5/19/1999	DA13125	Metolachlor	2.7	1	0.1
WSU050-0006	5/26/1999	DA13140	Metolachlor	0.4	1	0.1
WSU050-0006	6/3/1999	DA13166	Metolachlor	3.8	1	0.1
WSU050-0006	6/16/1999	DA13218	Metolachlor	0.8	1	0.1
WSU050-0006	6/16/1999	DA13229	Metolachlor	0.5	4	0.1
WSU050-0006	6/23/1999	DA13244	Metolachlor	0.9	4	0.1
White River near Petersburg						
WWL100-0005	4/28/1999	DA13027	Acetochlor	0.7	4	0.1
WWL100-0005	5/3/1999	DA13053	Acetochlor	0.2	4	0.1
WWL100-0005	5/17/1999	DA13105	Acetochlor	0.4	4	0.1
WWL100-0005	5/24/1999	DA13131	Acetochlor	1.2	4	0.1
WWL100-0005	6/7/1999	DA13183	Acetochlor	0.4	4	0.1
WWL100-0005	4/5/1999	DA13003	Atrazine (Aatrex)	2.4	4	0.1
WWL100-0005	4/28/1999	DA13027	Atrazine (Aatrex)	2.6	4	0.1
WWL100-0005	5/3/1999	DA13053	Atrazine (Aatrex)	1.1	4	0.1
WWL100-0005	5/17/1999	DA13105	Atrazine (Aatrex)	1.7	4	0.1
WWL100-0005	5/24/1999	DA13131	Atrazine (Aatrex)	8	4	0.1
WWL100-0005	6/1/1999	DA13157	Atrazine (Aatrex)	2.2	4	0.1
WWL100-0005	6/7/1999	DA13183	Atrazine (Aatrex)	3.2	4	0.1
WWL100-0005	6/14/1999	DA13209	Atrazine (Aatrex)	3.4	1	0.1
WWL100-0005	6/21/1999	DA13235	Atrazine (Aatrex)	1.9	4	0.1

Site Name	Date Sampled	Sample Number	Parameter	Conc. µg/L	Dilution factor	Report Limit µg/L
WWL100-0005	6/28/1999	DA13261	Atrazine (Aatrex)	2.5	1	0.1
WWL100-0005	7/6/1999	DA13287	Atrazine (Aatrex)	1	4	0.1
WWL100-0005	7/12/1999	DA13313	Atrazine (Aatrex)	0.7	4	0.1
WWL100-0005	7/19/1999	DA13339	Atrazine (Aatrex)	0.6	4	0.1
WWL100-0005	7/26/1999	DA13365	Atrazine (Aatrex)	0.7	4	0.1
WWL100-0005	4/28/1999	DA13027	Cyanazine (Bladex)	0.1	4	0.1
WWL100-0005	5/24/1999	DA13131	Cyanazine (Bladex)	0.7	1	0.1
WWL100-0005	4/5/1999	DA13003	Di(2-ethylhexyl)phthalate	8.6	1	0.1
WWL100-0005	4/28/1999	DA13027	Metolachlor	0.5	1	0.1
WWL100-0005	5/3/1999	DA13053	Metolachlor	0.5	1	0.1
WWL100-0005	5/24/1999	DA13131	Metolachlor	1	1	0.1
WWL100-0005	6/7/1999	DA13183	Metolachlor	0.7	10	0.1
WWL100-0005	6/14/1999	DA13209	Metolachlor	0.8	10	1
WWL100-0005	6/21/1999	DA13235	Metolachlor	0.5	4	0.1
WWL100-0005	4/28/1999	DA13027	Simazine	0.22	1	0.1
WWL100-0005	5/24/1999	DA13131	Simazine	0.39		

APPENDIX B
Field Data

Site Name	Sample	Date	Time	DO mg/L	pH	Temp C	Specific Conductivity uohms/cm	Turbidity NTU's	Flow CFS
Iroquois River at Rosebud									
UMI020-0002	DA13017	4/7/1999	10:00:00 AM	10.5	8	9.4	569	5.6	23.8
UMI020-0002	DA13041	4/29/1999	10:00:00 AM	7.95	7.62	9.85	551	14	67.2
UMI020-0002	DA13067	5/6/1999	2:30:00 PM	9.56	8	15.75	550	13.5	34
UMI020-0002	DA13093	5/12/1999	2:10:00 PM	8.8	8	19	543	126	28
UMI020-0002	DA13119	5/19/1999	2:10:00 PM	10.02	8.21	20.02	551	17.4	25.2
UMI020-0002	DA13145	5/26/1999	4:20:00 PM	9.96	8.33	18.44	547	23.4	22.9
UMI020-0002	DA13171	6/3/1999	3:00:00 PM	8.72	7.45	20.29	569	24.5	27
UMI020-0002	DA13197	6/9/1999	12:00:00 PM	8.38	8.01	25.67	558	27	21
UMI020-0002	DA13223	6/16/1999	12:20:00 PM	9.54	7.97	17.27	567	42.8	23
UMI020-0002	DA13249	6/23/1999	12:35:00 PM	8.13	7.93	22.86	572	51.5	14
UMI020-0002	DA13275	6/30/1999	5:05:00 PM	R	7.65	23.84	587	43.4	19
UMI020-0002	DA13301	7/8/1999	1:20:00 PM	8.83	7.93	24.03	578	46.8	21
UMI020-0002	DA13327	7/14/1999	1:40:00 PM	9.58	8.13	22.14	560	56	13
UMI020-0002	DA13353	7/21/1999	12:40:00 PM	7.43	7.81	26	545	51.2	14
UMI020-0002	DA13379	7/28/1999	12:30:00 PM	6.7	7.9	26	558	66	10.8
Iroquois River near Foresman									
UMI040-0001	DA13016	4/7/1999	9:05:00 AM	9.46	8.18	11.46	291	11.2	287
UMI040-0001	DA13040	4/29/1999	9:15:00 AM	9.4	7.8	10.05	500	48	1103
UMI040-0001	DA13066	5/6/1999	1:40:00 PM	8	7.9	17.4	607	20.7	450
UMI040-0001	DA13092	5/12/1999	1:30:00 PM	7.5	7.93	19.2	627	50	266
UMI040-0001	DA13118	5/19/1999	1:15:00 PM	7.45	7.94	19.61	632	41	297
UMI040-0001	DA13144	5/26/1999	3:45:00 PM	8.3	8.13	16.89	633	27	236
UMI040-0001	DA13170	6/3/1999	2:15:00 PM	7.22	7.4	20.05	613	61.9	409
UMI040-0001	DA13196	6/9/1999	11:20:00 AM	6.82	8.04	25.54	656	37.4	192
UMI040-0001	DA13222	6/16/1999	10:55:00 AM	8.44	8.02	18.46	652	55.9	347
UMI040-0001	DA13248	6/23/1999	11:10:00 AM	7.4	8.04	23.25	654	63.8	138
UMI040-0001	DA13274	6/30/1999	11:30:00 AM	R	7.87	21.61	626	63	262
UMI040-0001	DA13300	7/8/1999	11:40:00 AM	6.97	7.98	24.74	642	57.2	139
UMI040-0001	DA13326	7/14/1999	11:55:00 AM	7.53	8.23	23.06	676	67	65
UMI040-0001	DA13352	7/21/1999	11:20:00 AM	6.42	7.89	25.57	357	95.4	171
UMI040-0001	DA13378	7/28/1999	11:15:00 AM	6.33	8.01	26.62	647	96	58
Kankakee River at Davis									
UMK040-0003	DA13021	4/7/1999	1:20:00 PM	11	8	13	640	15.9	473
UMK040-0003	DA13045	4/29/1999	2:30:00 PM	4.12	7.52	13.37	576	27.7	1022
UMK040-0003	DA13071	5/7/1999	9:45:00 AM	8.14	7.9	15.4	593	12.2	567
UMK040-0003	DA13097	5/13/1999	9:45:00 AM	8.06	7.95	14.91	637	49.1	465

Site Name	Sample	Date	Time	DO mg/L	pH	Temp C	Specific Conductivity uohms/cm	Turbidity NTU's	Flow CFS
UMK040-0003	DA13123	5/20/1999	8:30:00 AM	7.89	8	16.13	633	25.1	482
UMK040-0003	DA13149	5/27/1999	8:20:00 AM	8.2	8.1	14.2	630	35	461
UMK040-0003	DA13175	6/4/1999	8:36:00 AM	7.66	7.56	17.06	635	36.1	431
UMK040-0003	DA13201	6/9/1999	4:40:00 PM	7.43	7.99	24.13	659	21.9	378
UMK040-0003	DA13227	6/16/1999	3:45:00 PM	8.61	8.03	17.29	649	46.6	403
UMK040-0003	DA13253	6/23/1999	4:15:00 PM	7.9	8.06	22.44	658	38.7	335
UMK040-0003	DA13279	6/30/1999	7:25:00 PM	R	7.79	20.97	658	57.7	470
UMK040-0003	DA13305	7/8/1999	4:45:00 PM	7.82	7.93	23	652	55.7	429
UMK040-0003	DA13331	7/14/1999	5:25:00 PM	8.1	8.2	22.35	663	57	232
UMK040-0003	DA13357	7/21/1999	4:00:00 PM	7.86	8.12	25.4	655	56	302
UMK040-0003	DA13383	7/28/1999	3:45:00 PM	7.57	8.07	26.7	652	67	269
Yellow River at Knox									
UMK060-0001	DA13022	4/7/1999	1:45:00 PM	9.5	8.2	14.34	604	8.3	425
UMK060-0001	DA13046	4/29/1999	2:50:00 PM	3.25	7.87	13.18	434	64.4	1600
UMK060-0001	DA13072	5/7/1999	9:15:00 AM	8.7	8.06	14.8	567	15	572
UMK060-0001	DA13098	5/13/1999	8:05:00 AM	8.07	8.11	14.52	605	12.2	437
UMK060-0001	DA13124	5/20/1999	8:00:00 AM	8.01	8.11	15.5	609	15	366
UMK060-0001	DA13150	5/27/1999	7:45:00 AM	9.33	8.17	12.58	598	27.6	436
UMK060-0001	DA13176	6/4/1999	8:00:00 AM	7.66	7.47	16.41	588	55.2	508
UMK060-0001	DA13202	6/9/1999	3:50:00 PM	7.66	8.16	25.41	634	19.1	293
UMK060-0001	DA13228	6/16/1999	3:05:00 PM	8.59	8.07	18.22	574	61.3	404
UMK060-0001	DA13254	6/23/1999	3:45:00 PM	9.16	8.33	23.22	632	39.1	214
UMK060-0001	DA13280	6/30/1999	7:00:00 PM	R	8.09	22.46	602	62	330
UMK060-0001	DA13306	7/8/1999	4:20:00 PM	7.97	8.06	25.01	618	42.7	259
UMK060-0001	DA13332	7/14/1999	5:00:00 PM	10.08	8.55	23.58	628	48.9	179
UMK060-0001	DA13358	7/21/1999	3:25:00 PM	9.52	8.4	27.52	616	54.4	162
UMK060-0001	DA13384	7/28/1999	4:00:00 PM	9.96	8.32	28.24	644	60	120
Kankakee River at Dunns Bridge									
UMK080-0001	DA13020	4/7/1999	12:30:00 PM	8.6	8	15.6	529	18.8	1410
UMK080-0001	DA13044	4/29/1999	1:30:00 PM	4.6	7.62	13.26	490	31	4130
UMK080-0001	DA13070	5/7/1999	8:20:00 AM	8.02	7.85	15.4	567	13.2	2550
UMK080-0001	DA13096	5/13/1999	9:00:00 AM	7.68	7.92	16	587	20.2	1760
UMK080-0001	DA13122	5/19/1999	4:40:00 PM	7.45	7.95	18.78	594	33	1460
UMK080-0001	DA13148	5/26/1999	6:20:00 PM	8.16	8.07	15.46	561	61.7	1560
UMK080-0001	DA13174	6/3/1999	5:25:00 PM	7.18	7.47	19.42	577	37.4	1360
UMK080-0001	DA13200	6/9/1999	3:10:00 PM	7	7.97	25.2	607	28.9	1050
UMK080-0001	DA13226	6/16/1999	2:30:00 PM	8.11	8.02	18.59	589	53.5	1220
UMK080-0001	DA13252	6/23/1999	3:00:00 PM	7.43	7.9	22.96	616	109	831
UMK080-0001	DA13278	6/30/1999	3:10:00 PM	R	7.78	22.03	604	55.7	1250
UMK080-0001	DA13304	7/8/1999	3:30:00 PM	7.35	7.87	24.2	604	56.2	1150

Site Name	Sample	Date	Time	DO mg/L	pH	Temp C	Specific Conductivity uohms/cm	Turbidity NTU's	Flow CFS
UMK080-0001	DA13330	7/14/1999	4:10:00 PM	7.53	8.07	23.23	632	56	783
UMK080-0001	DA13356	7/21/1999	2:45:00 PM	7.46	8.04	26.09	615	51.5	707
UMK080-0001	DA13382	7/28/1999	2:41:00 PM	7.37	8.11	26.81	642	68	552
Kankakee River at Shelby									
UMK110-0002	DA13019	4/7/1999	11:15:00 AM	9.4	8.13	13.05	608	12.3	1710
UMK110-0002	DA13043	4/29/1999	11:40:00 AM	5.04	7.77	12.1	473	35	4900
UMK110-0002	DA13069	5/6/1999	4:30:00 PM	8.12	7.93	16.9	585	13.1	4000
UMK110-0002	DA13095	5/12/1999	3:00:00 PM	7.6	7.9	17.8	621	40	2617
UMK110-0002	DA13121	5/19/1999	3:50:00 PM	7.52	7.99	19.86	636	38.3	1960
UMK110-0002	DA13147	5/26/1999	5:40:00 PM	8.39	8.14	15.96	598	31.7	1800
UMK110-0002	DA13173	6/3/1999	4:35:00 PM	7.21	7.51	20.2	586	46.1	1680
UMK110-0002	DA13199	6/9/1999	1:30:00 PM	7.23	8.02	25.67	622	30.5	1290
UMK110-0002	DA13225	6/16/1999	1:30:00 PM	8.3	8.04	19.29	634	49.6	1550
UMK110-0002	DA13251	6/23/1999	2:00:00 PM	7.71	7.98	22.88	690	48	962
UMK110-0002	DA13277	6/30/1999	4:30:00 PM	R	7.92	23.24	609	56	1410
UMK110-0002	DA13303	7/8/1999	2:30:00 PM	7.75	7.93	25.15	656	60	1470
UMK110-0002	DA13329	7/14/1999	3:10:00 PM	7.91	8.14	23.72	694	69.3	860
UMK110-0002	DA13355	7/21/1999	2:00:00 PM	7.48	8.07	26.59	633	62.9	787
UMK110-0002	DA13381	7/28/1999	1:50:00 PM	7.9	8.2	27.6	658	67	556
Singleton Ditch at Schneider									
UMK130-0001	DA13018	4/7/1999	10:45:00 AM	9	7.83	12	916	16.6	65
UMK130-0001	DA13042	4/29/1999	11:00:00 AM	7.56	5.9	11.32	472	91	734
UMK130-0001	DA13068	5/6/1999	3:30:00 PM	8.43	7.7	15.68	733	35.6	185
UMK130-0001	DA13094	5/12/1999	3:40:00 PM	7.4	7.7	18.5	857	57	127
UMK130-0001	DA13120	5/19/1999	3:20:00 PM	8.15	7.88	21.18	902	36.2	106
UMK130-0001	DA13146	5/26/1999	5:10:00 PM	8.2	8	19.4	939	34	95
UMK130-0001	DA13172	6/3/1999	4:00:00 PM	7.02	7.27	21.1	823	71.5	133
UMK130-0001	DA13198	6/9/1999	1:00:00 PM	6.58	7.75	25.37	943	53.9	57
UMK130-0001	DA13224	6/16/1999	1:05:00 PM	7.99	7.84	18.44	752	86.3	156
UMK130-0001	DA13250	6/23/1999	1:30:00 PM	7.7	7.8	23.03	939	75.8	68
UMK130-0001	DA13276	6/30/1999	4:00:00 PM	R	7.81	24.11	889	102	62
UMK130-0001	DA13302	7/8/1999	2:05:00 PM	7.26	7.8	25.9	940	78.7	69
UMK130-0001	DA13328	7/14/1999	2:35:00 PM	8.57	7.98	25.44	1023	66	48
UMK130-0001	DA13354	7/21/1999	1:30:00 PM	7.57	7.88	27.68	899	93.2	57
UMK130-0001	DA13380	7/28/1999	1:20:00 PM	10.99	8.09	30.14	1080	56	30
Wabash River at Terre Haute									
WBU040-0003	DA13007	4/6/1999	10:35:00 AM	11.32	8.4	17.04	618	18.6	8417
WBU040-0003	DA13031	4/27/1999	11:10:00 AM	8.95	8.09	14.44	472	180	28400
WBU040-0003	DA13057	5/3/1999	1:30:00 PM	7.52	7.65	21.66	335	39.6	20900
WBU040-0003	DA13083	5/10/1999	1:20:00 PM	10.79	8.4	19.78	609	47.9	11100

Site Name	Sample	Date	Time	DO mg/L	pH	Temp C	Specific Conductivity uohms/cm	Turbidity NTU's	Flow CFS
WBU040-0003	DA13109	5/17/1999	12:00:00 PM	9.6	8.3	21.45	600	22	11800
WBU040-0003	DA13135	5/24/1999	1:15:00 PM	8.6	8.29	19.8	589	75	11500
WBU040-0003	DA13161	6/1/1999	1:15:00 PM	8.72	7.92	23.52	626	66.2	8240
WBU040-0003	DA13187	6/7/1999	1:45:00 PM	7.36	7.77	25.83	561	73.9	17500
WBU040-0003	DA13213	6/14/1999	12:10:00 PM	6	8.08	25.91	579	81.1	9170
WBU040-0003	DA13239	6/21/1999	11:40:00 AM	9.96	8.16	23.56	640	80	6060
WBU040-0003	DA13265	6/28/1999	12:00:00 PM	11.7	8.2	27.42	581	51.1	5100
WBU040-0003	DA13291	7/6/1999	10:50:00 AM	9.55	6.99	30.9	547	52	4080
WBU040-0003	DA13317	7/12/1999	12:20:00 PM	9.78	8.4	27.51	583	62	2790
WBU040-0003	DA13343	7/19/1999	1:00:00 PM	9.26	8.32	30.48	558	69	2820
WBU040-0003	DA13369	7/26/1999	12:05:00 PM	9.76	7.91	32.15	504	81	2840
Wabash River at Riverton									
WBU150-0002	DA13006	4/6/1999	8:41:00 AM	10.18	8.5	15.78	628	86.8	9960
WBU150-0002	DA13030	4/27/1999	12:50:00 PM	8.63	8.02	15.65	461	391	31000
WBU150-0002	DA13056	5/3/1999	2:50:00 PM	8.93	8.03	18.23	508	48	24200
WBU150-0002	DA13082	5/10/1999	2:30:00 PM	9.76	8.41	20.16	600	74.7	13000
WBU150-0002	DA13108	5/17/1999	1:15:00 PM	7.95	8.1	21.7	580	80	13300
WBU150-0002	DA13134	5/24/1999	2:30:00 PM	9.1	8.4	20.2	593	39	11800
WBU150-0002	DA13160	6/1/1999	2:30:00 PM	7.79	7.89	23.14	597	124	9690
WBU150-0002	DA13186	6/7/1999	2:55:00 PM	7.08	7.96	25.34	536	143	21800
WBU150-0002	DA13212	6/14/1999	1:10:00 PM	6.2	7.99	26.14	543	158	10800
WBU150-0002	DA13238	6/21/1999	12:50:00 PM	9.03	8.21	23.2	630	158	7470
WBU150-0002	DA13264	6/28/1999	12:55:00 PM	9.42	8.13	26.76	579	73.3	6440
WBU150-0002	DA13290	7/6/1999	12:50:00 PM	9.2	8.1	30.7	572	65	5260
WBU150-0002	DA13316	7/12/1999	1:30:00 PM	8.24	8.22	26.83	571	77	3910
WBU150-0002	DA13342	7/19/1999	2:00:00 PM	10.28	8.46	30.16	573	79	3550
WBU150-0002	DA13368	7/26/1999	1:30:00 PM	9.1	8.38	32.05	565	55	3680
Busseron Creek near Carlisle									
WBU160-0002	DA13005	4/6/1999	8:00:00 AM	8.2	7.74	15.05	378	491	815
WBU160-0002	DA13029	4/27/1999	1:30:00 PM	8.71	7.81	16.1	788	35	181
WBU160-0002	DA13055	5/3/1999	3:35:00 PM	9.12	7.78	18.98	757	14.7	113
WBU160-0002	DA13081	5/10/1999	3:30:00 PM	7.87	7.75	20.69	870	39.2	99
WBU160-0002	DA13107	5/17/1999	1:45:00 PM	7	7.82	22	895	30	112
WBU160-0002	DA13133	5/24/1999	3:20:00 PM	7.1	7.77	18.9	622	68	401
WBU160-0002	DA13159	6/1/1999	3:15:00 PM	7.1	7.46	21.85	925	36	83
WBU160-0002	DA13185	6/7/1999	3:30:00 PM	6.64	7.49	26.48	488	105	499
WBU160-0002	DA13211	6/14/1999	1:45:00 PM	5.45	7.4	23.45	415	710	952
WBU160-0002	DA13237	6/21/1999	1:15:00 PM	7.53	7.76	22.92	907	55.9	74
WBU160-0002	DA13263	6/28/1999	1:30:00 PM	7.28	7.61	24.95	881	90.8	104
WBU160-0002	DA13289	7/6/1999	1:40:00 PM	6.1	7.68	28.35	948	70.2	61

Site Name	Sample	Date	Time	DO mg/L	pH	Temp C	Specific Conductivity uohms/cm	Turbidity NTU's	Flow CFS
WBU160-0002	DA13315	7/12/1999	2:00:00 PM	7.24	7.87	24.02	1035	80.9	49
WBU160-0002	DA13341	7/19/1999	2:40:00 PM	6.64	7.9	26.65	660	118	83
WBU160-0002	DA13367	7/26/1999	2:00:00 PM	6.34	7.95	28.2	1296	87	23
Wabash River at Vincennes									
WBU200-0003	DA13004	4/5/1999	6:55:00 PM	9.8	8.44	17.58	550	37.5	10887
WBU200-0003	DA13028	4/27/1999	3:00:00 PM	8.8	8.09	15.9	529	122	32640
WBU200-0003	DA13054	5/4/1999	11:00:00 AM	8.8	8.09	18.6	507	73	25740
WBU200-0003	DA13080	5/11/1999	11:00:00 AM	9.74	8.3	20.63	601	70	13010
WBU200-0003	DA13106	5/18/1999	10:45:00 AM	7.7	8.2	20.6	566	109	13600
WBU200-0003	DA13132	5/25/1999	11:30:00 AM	8.6	8.41	20.2	593	45	12690
WBU200-0003	DA13158	6/2/1999	11:20:00 AM	6.93	7.44	22.33	511	597	14900
WBU200-0003	DA13184	6/8/1999	11:15:00 AM	6.91	7.87	26.17	533	171	24660
WBU200-0003	DA13210	6/14/1999	2:35:00 PM	4.74	7.77	26.53	558	128	12830
WBU200-0003	DA13236	6/21/1999	2:10:00 PM	8.86	8.14	24.01	610	64.7	8158
WBU200-0003	DA13262	6/28/1999	2:30:00 PM	9.06	8.13	26.63	565	124	8028
WBU200-0003	DA13288	7/6/1999	2:35:00 PM	11	8.2	31.1	553	54	5846
WBU200-0003	DA13314	7/12/1999	3:00:00 PM	9.9	8.34	26.93	570	72	2612
WBU200-0003	DA13340	7/19/1999	3:25:00 PM	13.74	8.53	29.94	570	98.3	3805
WBU200-0003	DA13366	7/26/1999	3:05:00 PM	10.95	8.44	32.12	534	118	4103
Wabash River at Lafayette									
WLV010-0002	DA13015	4/6/1999	7:00:00 PM	12.3	8.6	13.9	577	13.3	4520
WLV010-0002	DA13039	4/26/1999	12:50:00 PM	9.56	8.13	13.57	457	125	20100
WLV010-0002	DA13065	5/6/1999	12:20:00 PM	9.31	8.34	17.5	535	14.4	580
WLV010-0002	DA13091	5/12/1999	11:30:00 AM	9.7	8.3	20.2	557	31	5300
WLV010-0002	DA13117	5/19/1999	11:30:00 AM	9.31	8.51	19.82	556	34.5	5140
WLV010-0002	DA13143	5/26/1999	2:20:00 PM	7.87	8.18	17.53	558	112	8600
WLV010-0002	DA13169	6/3/1999	12:45:00 PM	7.08	7.47	20.16	509	126	13200
WLV010-0002	DA13195	6/9/1999	10:00:00 AM	9.78	8.35	25.66	562	25.1	4560
WLV010-0002	DA13221	6/16/1999	9:50:00 AM	7.52	8.18	20.53	524	160	5240
WLV010-0002	DA13247	6/23/1999	10:10:00 AM	10.74	8.37	23.48	560	49.1	2790
WLV010-0002	DA13273	6/30/1999	10:25:00 AM	R	8.27	23.61	534	41.9	2890
WLV010-0002	DA13299	7/8/1999	10:05:00 AM	10.12	8.33	26.18	502	45.9	2060
WLV010-0002	DA13325	7/14/1999	10:40:00 AM	10.84	8.6	24.8	515	103	1640
WLV010-0002	DA13351	7/21/1999	10:10:00 AM	7.84	8.22	27.51	505	72.1	2310
WLV010-0002	DA13377	7/28/1999	10:15:00 AM	8.39	8.2	27.6	505	71	1400
Wabash River at Covington									
WLV080-0005	DA13013	4/6/1999	4:45:00 PM	12.66	8.69	13.3	603	19.2	9930
WLV080-0005	DA13037	4/26/1999	4:05:00 PM	9.36	8.11	13.5	456	190	9240
WLV080-0005	DA13063	5/5/1999	8:40:00 AM	9.1	8.2	17.43	560	27	25000
WLV080-0005	DA13089	5/12/1999	8:30:00 AM	9.63	8.44	19.87	594	53.7	5730

Site Name	Sample	Date	Time	DO mg/L	pH	Temp C	Specific Conductivity uohms/cm	Turbidity NTU's	Flow CFS
WLV080-0005	DA13115	5/19/1999	8:25:00 AM	9.84	8.49	18.73	580	27	5840
WLV080-0005	DA13141	5/26/1999	8:30:00 AM	8.43	8.37	15.74	608	41.6	13300
WLV080-0005	DA13167	6/3/1999	8:45:00 AM	7.13	7.35	20.55	558	193	6090
WLV080-0005	DA13193	6/8/1999	6:15:00 PM	13.06	8.7	26.84	605	35.3	6560
WLV080-0005	DA13219	6/15/1999	5:00:00 PM	8.84	8.29	23.35	578	123	3310
WLV080-0005	DA13245	6/22/1999	4:10:00 PM	14.5	8.58	24.29	597	60	4910
WLV080-0005	DA13271	6/29/1999	5:15:00 PM	15.85	8.58	25.4	575	54.5	2540
WLV080-0005	DA13297	7/7/1999	4:45:00 PM	15.1	8.75	28.71	448	63.7	1890
WLV080-0005	DA13323	7/13/1999	3:45:00 PM	15.81	8.95	26.24	531	83	1750
WLV080-0005	DA13349	7/20/1999	3:35:00 PM	15.24	8.81	28.25	528	79.3	1590
WLV080-0005	DA13375	7/27/1999	3:00:00 PM	14.52	9.04	31.02	506	82	2980
Wabash River at Montezuma									
WLV150-0001	DA13009	4/6/1999	12:00:00 PM	10.7	8.5	15.95	625	40.2	7260
WLV150-0001	DA13033	4/26/1999	5:00:00 PM	9.01	8.03	14.3	457	233	26500
WLV150-0001	DA13059	5/4/1999	2:40:00 PM		8.23	18.9	558	34	15500
WLV150-0001	DA13085	5/11/1999	2:25:00 PM	12.54	8.61	20.56	612	41.7	8880
WLV150-0001	DA13111	5/18/1999	2:00:00 PM	9.9	8.5	21.2	603	35	9334
WLV150-0001	DA13137	5/25/1999	3:15:00 PM	9.8	8.5	18.8	611	37	10380
WLV150-0001	DA13163	6/2/1999	3:00:00 PM	6.39	7.71	22.11	578	219	12120
WLV150-0001	DA13189	6/8/1999	5:15:00 PM	9.24	8.39	27.09	592	55.7	10600
WLV150-0001	DA13215	6/15/1999	4:10:00 PM	8.21	8.28	24.08	551	216	10900
WLV150-0001	DA13241	6/22/1999	3:15:00 PM	13.1	8.61	25.85	617	879	4960
WLV150-0001	DA13267	6/29/1999	4:30:00 PM	12.23	8.42	26.54	563	76.8	5490
WLV150-0001	DA13293	7/7/1999	3:50:00 PM	14.37	8.73	29.61	508	63	3630
WLV150-0001	DA13319	7/13/1999	5:00:00 PM	14.29	8.92	27.75	539	74.3	2180
WLV150-0001	DA13345	7/20/1999	3:00:00 PM	11.28	8.63	31.04	532	74.3	3340
WLV150-0001	DA13371	7/27/1999	4:15:00 PM	11.77	8.77	32.2	482	84	2220
Big Raccoon Creek near Fincastle									
WLV160-0002	DA13011	4/6/1999	2:55:00 PM	11.5	8.5	15.5	557	7.61	79
WLV160-0002	DA13035	4/27/1999	8:10:00 AM	8.99	8.16	14.3	584	9	124
WLV160-0002	DA13061	5/4/1999	4:20:00 PM	10.37	8.38	20.64	584	4.48	96
WLV160-0002	DA13087	5/11/1999	3:25:00 PM	9.87	8.25	21.72	600	19	64
WLV160-0002	DA13113	5/18/1999	3:00:00 PM	7.1	8.1	20.3	450	381	198
WLV160-0002	DA13139	5/25/1999	5:10:00 PM	9	8.3	15.8	601	22	150
WLV160-0002	DA13165	6/2/1999	4:30:00 PM	7.73	7.27	19.51	399	254	524
WLV160-0002	DA13191	6/8/1999	4:25:00 PM	8.3	8.16	27.51	634	15.1	71
WLV160-0002	DA13217	6/15/1999	3:15:00 PM	8.67	7.93	22.04	592	55.2	72
WLV160-0002	DA13243	6/22/1999	2:30:00 PM	10.45	8.28	24.97	624	29.6	33
WLV160-0002	DA13269	6/29/1999	3:30:00 PM	9.15	8.04	24.18	626	38.3	27
WLV160-0002	DA13295	7/7/1999	2:45:00 PM	8.96	8.11	29.01	608	69.9	13

Site Name	Sample	Date	Time	DO mg/L	pH	Temp C	Specific Conductivity uohms/cm	Turbidity NTU's	Flow CFS
WLV160-0002	DA13321	7/13/1999	4:00:00 PM	9.76	8.14	25.98	606	46	9
WLV160-0002	DA13347	7/20/1999	2:00:00 PM	9.71	8.25	27.48	478	74.2	24
WLV160-0002	DA13373	7/27/1999	3:10:00 PM	8.52	7.98	30.7	530	72	10
Big Raccoon Creek at Ferndale									
WLV170-0003	DA13010	4/6/1999	1:50:00 PM	10.8	8.5	16	60.9	13.1	23
WLV170-0003	DA13034	4/27/1999	9:00:00 AM	9.47	8.05	12.12	484	18.7	27
WLV170-0003	DA13060	5/4/1999	3:40:00 PM	10.45	8.04	15.9	474	34.5	28
WLV170-0003	DA13086	5/11/1999	4:00:00 PM	9.7	7.87	15.52	479	29	28
WLV170-0003	DA13112	5/18/1999	3:40:00 PM	9	7.8	14.4	476	16	28
WLV170-0003	DA13138	5/25/1999	4:10:00 PM	9	8	13.3	476	15	225
WLV170-0003	DA13164	6/2/1999	3:50:00 PM	8.94	7.46	15.67	474	26.1	121
WLV170-0003	DA13190	6/8/1999	3:40:00 PM	9.11	7.69	18.46	480	18.6	159
WLV170-0003	DA13216	6/15/1999	2:45:00 PM	9.2	7.71	16.4	477	39.6	245
WLV170-0003	DA13242	6/22/1999	1:45:00 PM	8.55	7.73	20.29	488	36.5	29
WLV170-0003	DA13268	6/29/1999	2:40:00 PM	9.3	7.77	18.71	478	42.5	82
WLV170-0003	DA13294	7/7/1999	2:05:00 PM	8.06	7.7	21.12	498	37.5	29
WLV170-0003	DA13320	7/13/1999	3:25:00 PM	8.07	7.83	21.03	497	43.7	28
WLV170-0003	DA13346	7/20/1999	1:20:00 PM	8.79	7.57	18.11	499	52	109
WLV170-0003	DA13372	7/27/1999	2:30:00 PM	7.82	7.86	22.4	507	58	29
Big Raccoon Creek at Coxville									
WLV190-0003	DA13008	4/6/1999	11:15:00 AM	9.3	8.5	17.4	1.7	8.59	210
WLV190-0003	DA13032	4/27/1999	10:20:00 AM	9.15	8.11	14.64	526	10.7	330
WLV190-0003	DA13058	5/4/1999	1:45:00 PM	9.36	8.17	20.33	547	9.16	218
WLV190-0003	DA13084	5/11/1999	1:30:00 PM	8.76	8.1	21.05	564	20.9	170
WLV190-0003	DA13110	5/18/1999	1:00:00 PM	8	8.1	20.2	527	15	197
WLV190-0003	DA13136	5/25/1999	2:15:00 PM	8.7	8.2	17.6	496	39	353
WLV190-0003	DA13162	6/2/1999	2:05:00 PM	7.65	7.34	19.27	311	652	1780
WLV190-0003	DA13188	6/8/1999	2:20:00 PM	8.43	8.08	24.99	506	29.2	455
WLV190-0003	DA13214	6/15/1999	1:40:00 PM	8.93	8.06	20.18	506	83.4	344
WLV190-0003	DA13240	6/22/1999	12:55:00 PM	8.89	8.08	23.24	599	35.8	136
WLV190-0003	DA13266	6/29/1999	1:30:00 PM	9.58	8.05	21.9	510	60.9	182
WLV190-0003	DA13292	7/7/1999	1:10:00 PM	8.15	7.98	26.31	585	39.2	95
WLV190-0003	DA13318	7/13/1999	2:20:00 PM	8.84	8.26	24.02	607	44	77
WLV190-0003	DA13344	7/20/1999	12:30:00 PM	7.03	7.72	24.6	175	998	1320
WLV190-0003	DA13370	7/27/1999	1:30:00 PM	8.03	7.95	27.61	570	70	100
Wabash River at Mt. Carmel									
WLW040-0001	DA13001	4/5/1999	3:45:00 PM	7.82	8.2	20.4	1300	75.5	35900
WLW040-0001	DA13025	4/28/1999	9:30:00 AM	8.4	7.9	15.17	497	182	56700
WLW040-0001	DA13051	5/4/1999	9:00:00 AM	8.77	8.09	17.15	508	64	25200
WLW040-0001	DA13077	5/11/1999	8:50:00 AM	9.1	8.29	20.12	581	64	47500

Site Name	Sample	Date	Time	DO mg/L	pH	Temp C	Specific Conductivity uohms/cm	Turbidity NTU's	Flow CFS
WLW040-0001	DA13103	5/18/1999	8:45:00 AM	7.9	8.2	20.5	576	40	26700
WLW040-0001	DA13129	5/25/1999	9:00:00 AM	7.3	8.2	20	564	43	24600
WLW040-0001	DA13155	6/2/1999	9:00:00 AM	7.93	7.71	22.6	586	156	20900
WLW040-0001	DA13181	6/8/1999	8:45:00 AM	5.8	7.6	24.8	434		49800
WLW040-0001	DA13207	6/15/1999	8:30:00 AM	7.94	8.11	23.73	535	155	23400
WLW040-0001	DA13233	6/22/1999	8:30:00 AM	9	8.22		600	154	13700
WLW040-0001	DA13259	6/29/1999	8:50:00 AM	7.82	7.81	23.87	410	218	22900
WLW040-0001	DA13285	7/7/1999	8:30:00 AM	8.35	7.7	28.8	533	84	16500
WLW040-0001	DA13311	7/13/1999	8:55:00 AM	9.11	8.44	25.78	538	67	10900
WLW040-0001	DA13337	7/20/1999	8:25:00 AM	11.54	8.16	29.47	522	11	7180
WLW040-0001	DA13363	7/27/1999	9:00:00 AM	10.25	8.2	31	494	99	7620
Patoka River nearPrinceton									
WPA080-0002	DA13002	4/5/1999	4:25:00 PM	7.64	7.4	16.8	479	111	1850
WPA080-0002	DA13026	4/28/1999	12:20:00 PM	8	7.49	15	344	292	2440
WPA080-0002	DA13052	5/3/1999	5:00:00 PM	6.86	7.72	19.53	448	39.2	2640
WPA080-0002	DA13078	5/10/1999	5:30:00 PM	7.46	7.31	20.4	673	119	1000
WPA080-0002	DA13104	5/17/1999	3:50:00 PM	6.7	7.74	22.6	1064	68	277
WPA080-0002	DA13130	5/24/1999	5:40:00 PM	7.1	7.81	20.1	1340	91	204
WPA080-0002	DA13156	6/1/1999	5:15:00 PM	6.85	7.44	22.59	1498	86.6	204
WPA080-0002	DA13182	6/7/1999	5:40:00 PM	5.8	7.5	25.2	761	128	684
WPA080-0002	DA13208	6/14/1999	4:40:00 PM	6.25	7.86	26.25	1287	77	190
WPA080-0002	DA13234	6/21/1999	4:00:00 PM	8.15	7.88	24	1790	76	126
WPA080-0002	DA13260	6/28/1999	4:20:00 PM	6.33	7.43	24.89	318	887	934
WPA080-0002	DA13286	7/6/1999	4:25:00 PM	5.25	7.8	28.7	331	46.2	3430
WPA080-0002	DA13312	7/12/1999	5:00:00 PM	4.98	7.87	24.11	428	74	2220
WPA080-0002	DA13338	7/19/1999	5:17:00 PM	7.11	7.71	27.96	1178	95.8	147
WPA080-0002	DA13364	7/26/1999	4:45:00 PM	7.8	7.92	30.1	1076	137	106
Prairie Creek near Lebanon									
WSU020-0004	DA13014	4/6/1999	6:00:00 PM	11.2	8.9	16.3	569	8.26	24
WSU020-0004	DA13038	4/26/1999	11:30:00 AM	10.81	8.18	12.84	750	7	39
WSU020-0004	DA13064	5/5/1999	10:20:00 AM	10.7	8.3	18.4	749	4.5	32
WSU020-0004	DA13090	5/12/1999	10:20:00 AM	11.3	8.34	20.46	821	6.64	18
WSU020-0004	DA13116	5/19/1999	10:30:00 AM	9.12	8.11	16.06	656	21.3	67
WSU020-0004	DA13142	5/26/1999	12:45:00 PM	10.26	8.43	16.82	757	8.2	31
WSU020-0004	DA13168	6/3/1999	10:35:00 AM	8.39	7.66	18.43	594	54.4	93
WSU020-0004	DA13194	6/9/1999	8:50:00 AM	8.73	8.2	23	803	11.1	19
WSU020-0004	DA13220	6/16/1999	9:00:00 AM	10.26	8.35	16.88	801	25.4	13
WSU020-0004	DA13246	6/23/1999	9:10:00 AM	10.11	8.38	21.68	858	26.1	9
WSU020-0004	DA13272	6/30/1999	9:20:00 AM	R	8.26	20.88	683	26	4
WSU020-0004	DA13298	7/8/1999	9:10:00 AM	7.93	8.13	23.36	747	95.5	3

Site Name	Sample	Date	Time	DO mg/L	pH	Temp C	Specific Conductivity uohms/cm	Turbidity NTU's	Flow CFS
WSU020-0004	DA13324	7/14/1999	9:40:00 AM	9.83	8.5	22.47	998	60	3
WSU020-0004	DA13350	7/21/1999	9:20:00 AM	7.92	8.17	25.87	794	39.1	6
WSU020-0004	DA13376	7/28/1999	9:10:00 AM	7.28	8.07	24.57	627	64	12
Sugar Creek at Crawfordsville									
WSU050-0006	DA13012	4/6/1999	3:45:00 PM	11.1	8.5	16.4	624	5.2	217
WSU050-0006	DA13036	4/26/1999	3:00:00 PM	11.46	8.46	14.01	641	10.2	516
WSU050-0006	DA13062	5/5/1999	9:30:00 AM	8.15	8.19	18.38	607	5.1	395
WSU050-0006	DA13088	5/12/1999	9:25:00 AM	6.99	8.01	20.5	625	7.74	205
WSU050-0006	DA13114	5/19/1999	9:20:00 AM	8.14	8.19	17.15	588	29.6	245
WSU050-0006	DA13140	5/26/1999	9:45:00 AM	8.81	8.41	14.65	651	12.1	374
WSU050-0006	DA13166	6/3/1999	9:35:00 AM	8.2	7.46	17.87	506	143	1933
WSU050-0006	DA13192	6/9/1999	7:50:00 AM	7.06	8.21	24.77	650	18.3	275
WSU050-0006	DA13218	6/16/1999	8:10:00 AM	8.34	8.27	18.39	631	46.6	267
WSU050-0006	DA13244	6/23/1999	8:00:00 AM	6.81	7.93	22.13	591	39.8	138
WSU050-0006	DA13270	6/30/1999	8:15:00 AM	R	8.09	21.39	679	33.1	133
WSU050-0006	DA13296	7/8/1999	8:10:00 AM	6.08	8.05	24.46	641	32.9	53
WSU050-0006	DA13322	7/14/1999	8:35:00 AM	7.01	8.22	23.2	633	26.8	29
WSU050-0006	DA13348	7/21/1999	8:23:00 AM	5.85	8.04	26.25	593	43.7	69
WSU050-0006	DA13374	7/28/1999	8:20:00 AM	6	8.07	28.3	571	53	23
White River near Petersburg									
WWL100-0005	DA13003	4/5/1999	5:35:00 PM	10.4	8.25	16	503	67.9	13500
WWL100-0005	DA13027	4/28/1999	1:00:00 PM	8.4	7.88	16.2	469	81	17500
WWL100-0005	DA13053	5/3/1999	6:05:00 PM	9.07	8.12	19.19	481	48	15000
WWL100-0005	DA13079	5/10/1999	4:45:00 PM	10.45	8.42	21.11	535	55.6	9880
WWL100-0005	DA13105	5/17/1999	3:00:00 PM	10.3	8.5	23.5	572	56	8510
WWL100-0005	DA13131	5/24/1999	4:45:00 PM	7.4	7.9	20.5	503	122	10200
WWL100-0005	DA13157	6/1/1999	4:30:00 PM	10.71	7.9	24.61	579	43.7	13500
WWL100-0005	DA13183	6/7/1999	4:50:00 PM	7.77	7.98	26.89	5.14	144	13900
WWL100-0005	DA13209	6/14/1999	4:00:00 PM	5.56	8.36	27.81	580	110	6160
WWL100-0005	DA13235	6/21/1999	3:20:00 PM	11.42	8.45	26.63	603	86	4390
WWL100-0005	DA13261	6/28/1999	3:35:00 PM	7.01	7.78	26.21	450	334	6400
WWL100-0005	DA13287	7/6/1999	3:40:00 PM	11.38	8.5	31.11	572	87.3	6260
WWL100-0005	DA13313	7/12/1999	4:10:00 PM	13.48	8.78	28.26	570	86.2	4020
WWL100-0005	DA13339	7/19/1999	4:35:00 PM	10.48	8.54	31.72	577	58.2	2770
WWL100-0005	DA13365	7/26/1999	4:00:00 PM	10.39	8.66	34	599	75	3310

Appendix C
Descriptive Statistics

Iroquois River near Rosebud	Valid N	Mean	Confid. -95.000%	Confid. 95.000	Sum	Minimum	Maximum	Range	Variance	Std.Dev.
ACETO	15	0.020	-0.023	0.063	0.300	0.000	0.300	0.300	0.006	0.077
ATRA	15	0.147	0.005	0.288	2.200	0.000	0.700	0.700	0.066	0.256
METO	16	6.375	-7.071	19.821	102.000	0.000	101.000	101.000	636.755	25.234

Iroquois River near Foresman	Valid N	Mean	Confid. -95.000%	Confid. 95.000	Sum	Minimum	Maximum	Range	Variance	Std.Dev.
ACETO	15	0.060	-0.018	0.138	0.900	0.000	0.500	0.500	0.020	0.140
ATRA	15	0.367	0.036	0.697	5.500	0.000	2.100	2.100	0.357	0.597
METOL	15	0.073	-0.056	0.203	1.100	0.000	0.900	0.900	0.055	0.234

Kankakee River at Dunns Bridge	Valid N	Mean	Confid. -95.000%	Confid. 95.000	Sum	Minimum	Maximum	Range	Variance	Std.Dev.
ACETO	15	0.160	-0.183	0.503	2.400	0.000	2.400	2.400	0.384	0.620
ATRA	15	0.467	-0.419	1.352	7.000	0.000	6.200	6.200	2.558	1.599
METOL	15	0.000			0.000	0.000	0.000	0.000	0.000	0.000

Kankakee River at Shelby	Valid N	Mean	Confid. -95.000%	Confid. 95.000	Sum	Minimum	Maximum	Range	Variance	Std.Dev.
ACETO	15	0.000			0.000	0.000	0.000	0.000	0.000	0.000
ATRA	15	0.047	-0.053	0.147	0.700	0.000	0.700	0.700	0.033	0.181
METOL	15	0.007	-0.008	0.021	0.100	0.000	0.100	0.100	0.001	0.026

Kankakee River near Davis										
	Valid N	Mean	Confid. -95.000%	Confid. 95.000	Sum	Minimum	Maximum	Range	Variance	Std.Dev.
ACETO	15	0.000			0.000	0.000	0.000	0.000	0.000	0.000
ATRA	15	0.040	-0.046	0.126	0.600	0.000	0.600	0.600	0.024	0.155
METOL	15	0.000			0.000	0.000	0.000	0.000	0.000	0.000

Singleton Ditch near Schneider										
	Valid N	Mean	Confid. -95.000%	Confid. 95.000	Sum	Minimum	Maximum	Range	Variance	Std.Dev.
ACETO	15	0.160	-0.020	0.340	2.400	0.000	1.100	1.100	0.105	0.325
ATRA	15	0.620	-0.123	1.363	9.300	0.000	4.400	4.400	1.799	1.341
METOL	15	0.107	-0.048	0.261	1.600	0.000	1.000	1.000	0.078	0.279

Yellow River at Knox										
	Valid N	Mean	Confid. -95.000%	Confid. 95.000	Sum	Minimum	Maximum	Range	Variance	Std.Dev.
ACETO	15	0.187	-0.032	0.405	2.800	0.000	1.100	1.100	0.156	0.394
ATRA	15	0.753	-0.044	1.551	11.300	0.000	3.800	3.800	2.073	1.440
METOL	15	0.000			0.000	0.000	0.000	0.000	0.000	0.000

Big Raccoon Creek near Coxville										
	Valid N	Mean	Confid. -95.000%	Confid. 95.000	Sum	Min	Max	Range	Variance	Std.Dev.
ACETO	15	0.060	-0.042	0.162	0.900	0.000	0.700	0.700	0.034	0.184
ATRA	15	1.353	0.532	2.174	20.300	0.000	5.300	5.300	2.198	1.483
METOL	15	0.300	-0.016	0.616	4.500	0.000	2.000	2.000	0.326	0.571

Big Raccoon Creek near Ferndale										
	Valid N	Mean	Confid. -95.000%	Confid. 95.000	Sum	Minimum	Maximum	Range	Variance	Std.Dev.
ACETO	25	0.004	-0.004	0.012	0.100	0.000	0.100	0.100	0.000	0.020
ATRA	25	1.308	1.079	1.537	32.700	0.000	2.100	2.100	0.307	0.554
METOL	25	0.376	0.263	0.489	9.400	0.000	0.800	0.800	0.075	0.274

Big Raccoon Creek near Fincastle										
	Valid N	Mean	Confid. -95.000%	Confid. 95.000	Sum	Minimum	Maximum	Range	Variance	Std.Dev.
ACETO	15	0.080	-0.037	0.197	1.200	0.000	0.600	0.600	0.045	0.211
ATRA	15	1.473	-0.117	3.064	22.100	0.000	9.900	9.900	8.248	2.872
METOL	15	0.607	-0.162	1.376	9.100	0.000	4.900	4.900	1.928	1.388

Busseron Creek near Carlisle										
	Valid N	Mean	Confid. -95.000%	Confid. 95.000	Sum	Minimum	Maximum	Range	Variance	Std.Dev.
ACETO	15	0.613	0.111	1.116	9.200	0.000	3.200	3.200	0.823	0.907
ATRA	15	8.173	-1.905	18.252	122.600	0.400	73.000	72.600	331.205	18.199
METOL	15	0.180	-0.040	0.400	2.700	0.000	1.400	1.400	0.157	0.397

Prarie Creek near Lebanon										
	Valid N	Mean	Confid. -95.000%	Confid. 95.000	Sum	Minimum	Maximum	Range	Variance	Std.Dev.
ACETO	15	0.000			0.000	0.000	0.000	0.000	0.000	0.000
ATRA	15	2.620	0.137	5.103	39.300	0.000	16.000	16.000	20.107	4.484
METOL	15	4.207	-3.582	11.995	63.100	0.000	55.000	55.000	197.809	14.064

Patoka River near Princeton										
	Valid N	Mean	Confid. -95.000%	Confid. 95.000	Sum	Minimum	Maximum	Range	Variance	Std.Dev.
ACETO	15	0.267	0.088	0.445	4.000	0.000	0.900	0.900	0.104	0.322
ATRA	15	5.053	1.801	8.306	75.800	0.000	24.000	24.000	34.501	5.874
METOL	15	0.980	0.291	1.669	14.700	0.000	5.100	5.100	1.549	1.245

Sugar Creek at Crawfordsville										
	Valid N	Mean	Confid. -95.000%	Confid. 95.000	Sum	Minimum	Maximum	Range	Variance	Std.Dev.
ACETO	17	0.076	-0.012	0.165	1.300	0.000	0.500	0.500	0.029	0.171
ATRA	17	1.806	0.522	3.090	30.700	0.000	7.300	7.300	6.237	2.497
METOL	17	0.700	0.110	1.290	11.900	0.000	3.800	3.800	1.319	1.148

Wabash River at Lafayette										
	Valid N	Mean	Confid. -95.000%	Confid. 95.000	Sum	Minimum	Maximum	Range	Variance	Std.Dev.
ACETO	15	0.313	0.054	0.573	4.700	0.000	1.200	1.200	0.220	0.469
ATRA	15	2.033	0.884	3.182	30.500	0.000	6.500	6.500	4.304	2.075
METOL	15	0.460	0.060	0.860	6.900	0.000	2.200	2.200	0.521	0.722

Wabash River at Riverton										
	Valid N	Mean	Confid. -95.000%	Confid. 95.000	Sum	Minimum	Maximum	Range	Variance	Std.Dev.
ACETO	15	0.227	0.021	0.432	3.400	0.000	1.200	1.200	0.138	0.371
ATRA	15	1.840	0.613	3.067	27.600	0.000	6.700	6.700	4.910	2.216
METOL	15	0.387	0.044	0.729	5.800	0.000	1.700	1.700	0.383	0.619

Wabash River at Terre Haute	Valid N	Mean	Confid. -95.000%	Confid. 95.000	Sum	Minimum	Maximum	Range	Variance	Std.Dev.
ACETO	15	0.140	0.020	0.260	2.100	0.000	0.500	0.500	0.047	0.216
ATRA	15	1.333	0.780	1.886	20.000	0.000	3.500	3.500	0.997	0.998
METOL	15	0.293	0.094	0.492	4.400	0.000	1.000	1.000	0.129	0.359

Wabash River at Vincennese	Valid N	Mean	Confid. -95.000%	Confid. 95.000	Sum	Minimum	Maximum	Range	Variance	Std.Dev.
ACETO	15	0.333	0.066	0.600	5.000	0.000	1.400	1.400	0.232	0.482
ATRA	15	3.367	1.329	5.404	50.500	0.400	11.000	10.600	13.541	3.680
METOL	15	0.607	0.241	0.972	9.100	0.000	1.700	1.700	0.435	0.660

White River near Petersburg	Valid N	Mean	Confid. -95.000%	Confid. 95.000	Sum	Minimum	Maximum	Range	Variance	Std.Dev.
ACETO	14	0.207	-0.001	0.415	2.900	0.000	1.200	1.200	0.130	0.360
ATRA	14	2.286	1.196	3.376	32.000	0.600	8.000	7.400	3.563	1.888
METOL	14	0.286	0.075	0.497	4.000	0.000	1.000	1.000	0.134	0.366

Wabash River at Covington	Valid N	Mean	Confid. -95.000%	Confid. 95.000	Sum	Minimum	Maximum	Range	Variance	Std.Dev.
ACETO	15	0.167	0.022	0.311	2.500	0.000	0.700	0.700	0.068	0.261
ATRA	15	1.653	0.734	2.573	24.800	0.000	6.400	6.400	2.758	1.661
METOL	15	0.353	0.044	0.662	5.300	0.000	2.000	2.000	0.311	0.558

Wabash River at Montezuma										
	Valid N	Mean	Confid. -95.000%	Confid. 95.000	Sum	Minimum	Maximum	Range	Variance	Std.Dev.
ACETO	15	0.133	0.012	0.255	2.000	0.000	0.600	0.600	0.048	0.219
ATRA	15	1.280	0.733	1.827	19.200	0.000	3.100	3.100	0.975	0.987
METOL	15	0.280	0.114	0.446	4.200	0.000	0.700	0.700	0.090	0.300

Wabash River at Mount Carmel, IL										
	Valid N	Mean	Confid. -95.000%	Confid. 95.000	Sum	Minimum	Maximum	Range	Variance	Std.Dev.
ACETO	15	0.347	0.080	0.613	5.200	0.000	1.500	1.500	0.231	0.481
ATRA	15	8.913	-3.479	21.306	133.700	0.700	89.000	88.300	500.783	22.378
METOL	15	0.573	0.182	0.965	8.600	0.000	2.700	2.700	0.499	0.707